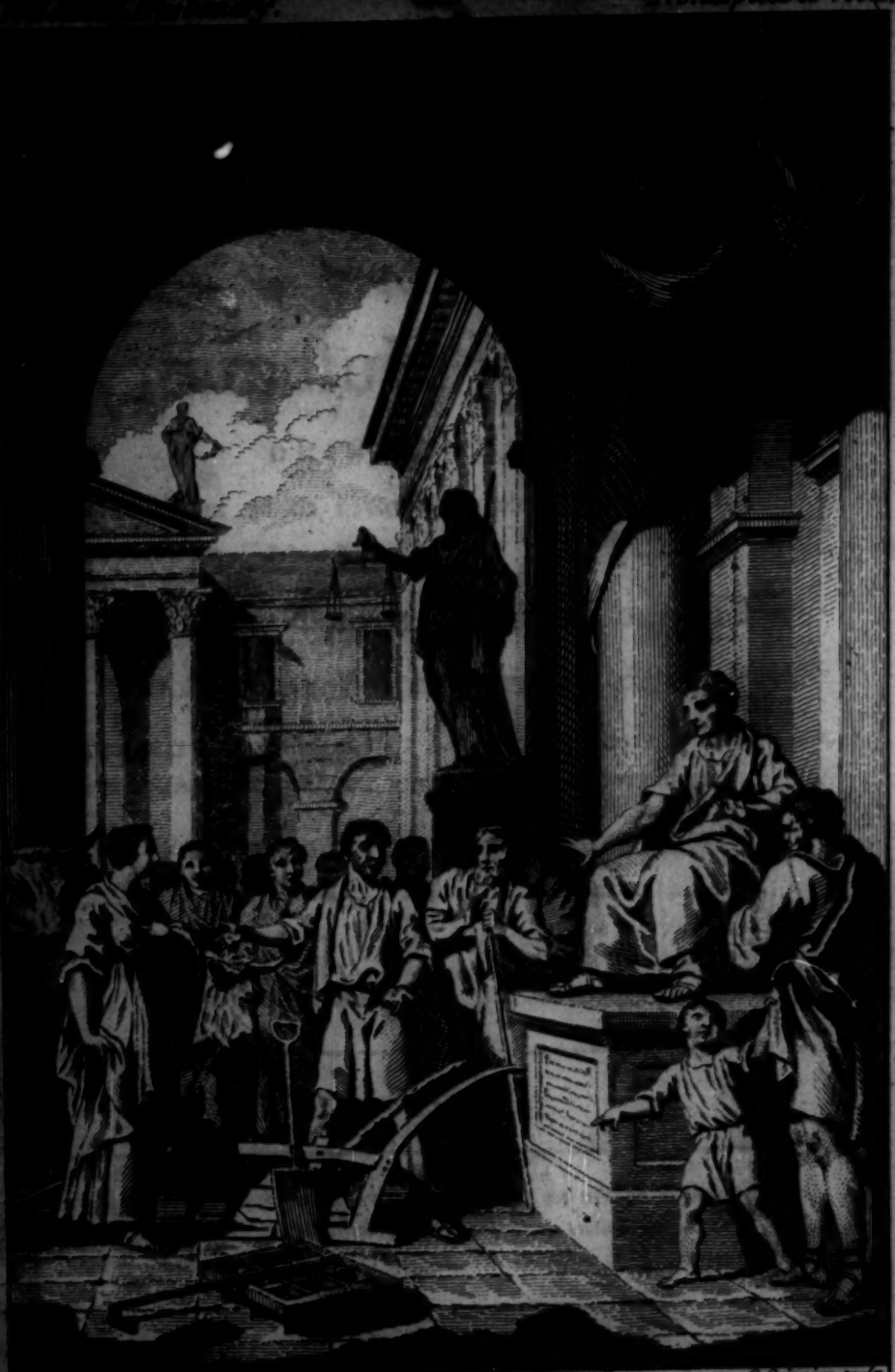
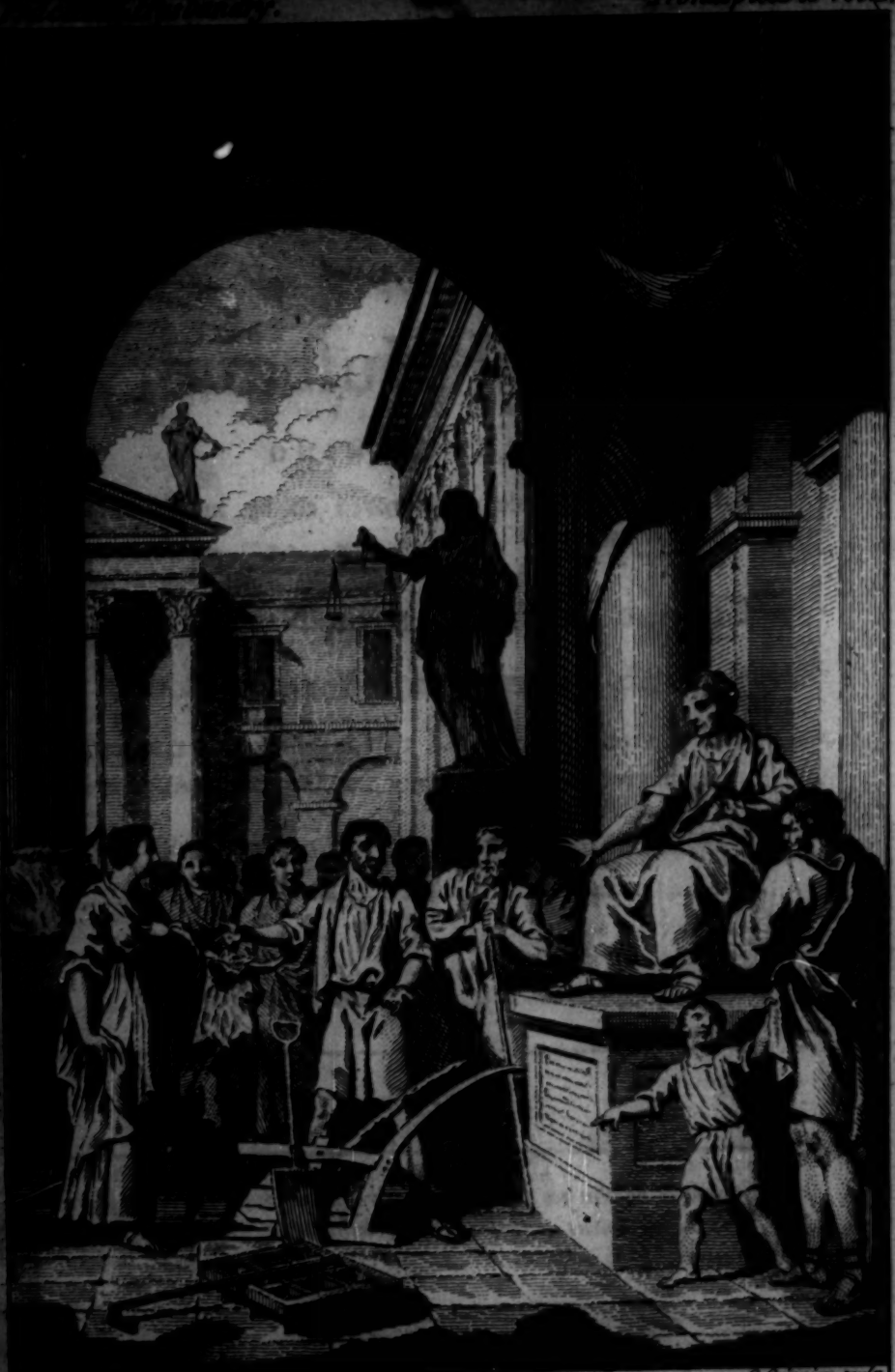


C. Grignion sculp.

C. FURIUS CRESINUS being cited before the Curule Edile & an Assembly of the People, to answer to a charge of Sorcery, founded on his reaping much larger Crops from his very small spot of Ground, than his Neighbours did from their extensive Fields; produces his strong implements of Husbandry, his well-fed Oxen & a hale young Woman his Daughter, and pointing to them, says, These, Romans! are my Instruments of Witchcraft:—But I cannot shew you my Labours, Sweats and anxious Cares.

PLIN. Nat. Hist. B. XVIII. c. 6.



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Augustine A Shottowe

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All that Experience has proved to be most useful in

FARMING,

EITHER IN THE OLD OR NEW METHOD;

With a Comparative View of Both;

And whatever is beneficial to the HUSBANDMAN, or conducive to the Ornament and Improvement of the

COUNTRY GENTLEMAN'S ESTATE.

By JOHN MILLS, Esq;
Editor of DU HAMEL'S Husbandry.

VOL. I.

Omnium rerum ex quibus aliquid conquiritur, nihil est Agriculturâ melius, nihil uberius, nihil dulcius, nihil homine, nihil libero dignius. CIC. OFF. l. 1.

LONDON:
Printed for R. BALDWIN, W. JOHNSTON, S. CROWDER, T. LONGMAN, J. COOTE, J. HINXMAN, W. NICOLL, and S. DAVIS.

MDCC LXII.

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T. Lowndes, J. Coote, J. Hinxman,
W. Nicoll, and S. Davis.

MDCC LXII.

TO

THE RIGHT HONOURABLE

JAMES STUART MACKENZIE.

SIR,

THE ſignal Encouragement and Protection which You have given to Agriculture, diſtinguiſh You as the fitteſt Patron of a Work intended to promote the Practice of that moſt uſeful Art. The ſincereſt Homage is juſtly due to that noble Benevolence which characteriſes the truly Great and Good. Permit me, therefore, reſpectfully to inſcribe this Treatiſe to You, as a Teſtimony of the Sentiments of Veneration with which I am,

SIR,

Your moſt obedient,

London, February the 22, 1763.

and moſt humble Servant,

John Mills.

PREFACE.

IF we look into the earlieſt accounts of the Aſiatic nations, we ſhall find, from their magnificent and populous cities, and their numerous armies, room to think that Agriculture was then arrived at conſiderable perfection, ſince it could ſupply the inhabitants in general with all the neceſſaries of life, and the great with the moſt delicate luxuries. This will appear ſtill more evidently, if we reflect on the judicious conduct of the Egyptians, in the diſpoſition of their country, with reſpect to the inundations of the Nile, and the great advantages which they had been taught to reap from it, as deſcribed by Herodotus. The poſſeſſions of the children of Iſrael muſt have been cultivated with the utmoſt ſkill, or they could not have afforded ſuſtenance to the prodigious numbers of people, who, as indiſputable authority informs us, inhabited that ſmall ſpot. But time has robbed us of their knowledge in this moſt uſeful of Arts.

In the moſt enlightened ages, books of Huſbandry were compoſed by men whoſe exalted ſtation proves the high value then ſet upon the Art which they taught. Xenophon, equally diſtinguiſhed in philoſophy and in arms, ſhews, by his commendations of Cyrus, the eſtimation in which Agriculture was held by both thoſe great men. Hieron, king of Syracuſe, did not think it beneath him to write upon this eſſential Art, for the benefit of his ſubjects. The chiefs of the two greateſt Republics in the world, Cato, Conſul of Rome, and Mago, Sufetes of Carthage *, are, in the opinion of the ancients, the moſt celebrated writers upon rural affairs. Amidſt the Aſiatic luxury, and that of the Roman empire, valuable treatiſes of Huſbandry appeared, written by Attalus, king of Pergamus; by Archelaus, king of Cappadocia; by Valerius Aſiaticus, who was judged worthy of the empire after the death of Caligula; and by the emperor Albinus.

Some few fragments of the Greeks are the firſt rudiments of Huſbandry, upon record; and the elder Cato is the moſt ancient Latin author whoſe writings upon this intereſting ſubject have reached us. His inſtructions are very judicious, but too conciſe. Varro added elegance of language to an improved treatiſe of Agriculture; and, ſoon after him,

* Mago wrote twenty-eight books of Huſbandry, which were tranſlated by order of the Roman Senate.

Virgil publiſhed his juſtly admired Georgics; by far the moſt laboured and highly finiſhed of all his works, that which he had moſt at heart, and that upon which he choſe to reſt his future reputation. Columella afterwards collected, with great judgment, whatever was valuable in the writings of his predeceſſors, and enriched them with his own perfect knowledge of the ſubject. His work is one of the choiceſt remains of antiquity, and has ſcarcely been equalled by any author ſince.

The irruptions of the barbarous nations of the North, unacquainted with the ſweets of ſociety and the bleſſings of civil liberty, ſoon aboliſhed improved Agriculture. Arms were their only object. Their meaneſt ſlaves were intruſted with their trifling huſbandry; and trifling it muſt have been during that unſettled ſtate of nations. Thoſe inumerable and enterprizing barbarians, who over-ran all Europe, were originally ſhepherds or hunters, like the preſent Tartars and the ſavages of America. They contented themſelves with poſſeſſing, without labour or trouble, the vaſt deſarts which their arms had made, and cultivated, very ſuperficially, only a ſmall ſpot near their habitations. The abject condition of thoſe whom they employed for this purpoſe, unfortunately and unjuſtly made the occupation itſelf then be looked upon as mean and ignoble. But when governments began to be founded upon more fixed and rational plans, Agriculture, with the other Arts,

reared it's head, and throve in proportion as property became ſecure. A Commonwealth gave the firſt riſe to the ſalutary change: for Venice may boaſt, that her Camillo Tarello was the firſt good author on this important ſubject, after the revival of uſeful knowledge.

The improvements made in England, in the reign of Queen Elizabeth, ſhew, that the Proteſtants who were obliged to take ſhelter in the then free ſtates, and particularly in Swiſſerland, had, with their love of Liberty, learnt an improved Agriculture. In the next age, Hartlib is not leſs famed for his knowledge in farming, than for his friendſhip with Milton. The return of the men of genius, who had fled their country during Cromwell's uſurpation, and the protection granted them after the Reſtoration, added greatly to the progreſs of Agriculture. At this period, from which England may date her grandeur, wealth, and power, writers of great character took in hand the truly patriotic theme. —Such were Platt, Worlidge, Evelyn, *&c.* whoſe works did honour to the age, and proved highly beneficial to their country. The ſame laudable ſpirit appeared in an elegant ſyſtem publiſhed about this time by the ingenious and learned Counſellor Conrad Herreſbach, in Germany; where a ſpecial attention to Agriculture had begun to be the great object of ſeveral ſtates, when a total ſtop was unhappily put to every thing of this kind, by the preſent deſtructive war.

In

In France, two eminent phyſicians* thought this ſubject worthy of their pens, and gave their country the *Maiſons ruſtiques*, a work which, afterwards perfected by a third phyſician†, has undergone twenty-two editions. Nor does that country now by any means loſe ſight of this important object. Real philoſophers there make it their ſtudy, and purſue a ſeries of well made experiments, with ſuch indefatigable care and accuracy, as cannot but be productive of very great advantages; whilſt their Monarch wiſely protects and patronizes their undertakings. So the Emperor of China, throughout his wide dominions, rewards the huſbandman who makes the beſt and greateſt improvements in his land, with the dignity of a Mandarin of the eighth claſs. The names of ſeveral illuſtrious Improvers in France, deſervedly diſtinguiſhed for their patriotic application to this ſtudy, will grace the following work. A Society in Britany, in particular, have begun upon a moſt judicious plan, which promiſes ſuch ſucceſs as muſt prove extremely beneficial to their country.

In Swiſſerland, a Society eſtabliſhed at Berne has already favoured the world with ſuch ſpecimens of the great judgment of it's illuſtrious members, as leave no room to doubt but that their diſtinguiſhed care and aſſiduity will be

* Liebaut & Deſerre. † M. Liger.

a laſting ſource of advantages to all mankind.

In Sweden, a genius has ariſen, who will ever deſerve the higheſt commendation in the hiſtory of Agriculture; though this is but a ſecondary part in his character. Linnæus has rouſed a ſpirit of inquiry into, and love of natural knowledge, which will undoubtedly be attended with conſpicuous emoluments to his native land.

In Denmark, a King, who, like Our Moſt Auguſt Sovereign, makes the happineſs of his people the chief object of his care, is ſo attentive to Agriculture, that thoſe gentlemen who travel at his expence, to become maſters of, and to introduce into his kingdom, every uſeful Art, are directed to be peculiarly attentive to This. The uſeful Arts are the elder ſiſters of the pleaſing ones, and therefore muſt neceſſarily precede them, as is juſtly obſerved by another illuſtrious Prince ‡.

The general ſpirit of improvement in Agriculture ſo remarkably exerted in the different nations of Europe, calls upon Us not to loſe that ſuperiority which the happineſs of our conſtitution and climate have given us.

The Society of Improvers in the Knowledge of Agriculture in Scotland will ever deſerve ſincere thanks for many proofs of that truly laudable ſpirit which conſults the gene-

‡ Memoires de Brandebourg, Tom I. p. 177. 4°.

ral

ral good of men; and is particularly intitled to our grateful acknowledgement, that it's worthy members ſet the noble example firſt followed by the Dublin Society, next by another Society at Edinburgh, and now by one in London, in the more extenſive manner of adding premiums to the inſtruction only which the former gave.

The Society in Dublin have diſtinguiſhed themſelves ſo remarkably by their ſound and unbiaſſed judgment and aſſiduity in promoting the real intereſt of their country, that the Parliament of that kingdom are now become their patrons, and have, with a truly public ſpirit, ordered large ſums for carrying into execution their patriotic purpoſes. Their obſervations, replete with excellent inſtructions, want only to be continued and increaſed.

To the Society in Edinburgh, the world is indebted for the very ingenious Dr. Home's Treatiſes, on Bleaching, and on the Principles of Vegetation: works which not only do honour to the Society, but are greatly uſeful to the public.

The London Society for the Encouragement of Arts, Manufactures, and Commerce, is formed upon a plan ſo univerſally beneficent,, and directed by Gentlemen of ſuch high rank, and great abilities, as, when we conſider that they actually take every opportunity which prudence and intelligence can ſuggeſt, to promote the laſting welfare of their fellow citizens, ſcarcely leaves room for any farther

farther wiſh, unleſs it be, that they would impart to the whole world ſome portion of their treaſures of uſeful knowledge.

That the real ſtrength of every country depends upon it's population, is a well known truth; and a little acquaintance with the principles of ſound policy will ſhew, that the only ſolid baſis of a numerous population, is Agriculture. Without this, the ſubſiſtance of a nation is precarious. Uncertainty of ſubſiſtance hinders people from marrying, and even induces them to quit their native ſoil. Huſbandmen, whoſe children are their riches, are, of all perſons, the fitteſt and moſt inclined to propagate their ſpecies. Trade, though a great, is but a ſecondary, ſource of wealth, and will, if carried too far, deſtroy the parent which gave it birth, by diminiſhing Agriculture, depopulating the country, and annihilating by degrees that eſſentially neceſſary claſs of men who cultivate the earth. Indolence and avidity will tempt them to quit a laborious occupation, for one that is attended with leſs toil and more lucre; though it be at the ſame time very precarious. The eaſe with which the artificers of luxury live, ſeduces the indigent peaſant, draws him to towns and cities, and the country is deſerted. But if Agriculture be properly countenanced, encouraged, and put in ſo flouriſhing a ſtate as to afford a comfortable ſubſiſtance to the very great numbers that may be employed in it; the huſbandman will not forſake the ſolid occupa-

occupation of his fore-fathers, to which he has been trained up; commerce will not exceed the bounds within which it ought to keep; luxury, that bane of mankind, will be effectually checked; and a martial ſpirit will animate every free-born youth:—for the courage of the lower claſs of unemployed people is but a kind of machinal inſtinct, allied at moſt with a certain love for their country, blended with the love of their own poſſeſſions. It is the robuſt labourer, hardened by fatigue, and by being expoſed to all ſorts of weather, who has the greateſt inward feeling of his own ſtrength:—it is the huſbandman who is moſt firmly attached to his country, by the portion of land which maintains him. The Artiſt, who ſettles wherever he finds employment, cannot, ſtrictly ſpeaking, be ſaid to have any country. Though an uſeful member of the community, his retired ſedentary life weakens his body, and depreſſes the ſpring of that ſpirit of Liberty, which elevates the ſoul as much as the ſervile ways of Luxury debaſe it:---of that ſpirit which ſo nobly diſtinguiſhed our iluſtrious fore-fathers, and which we have ſeen moſt happily and ſignally revived in our preſent brave militia, ever ready to defend the ſacred rights of their king and country.---Such was the ſpirit of the real Romans, of thoſe Conquerors of the world, whoſe only profeſſions were Arms and Agriculture, and who made equal improvements in both: nor, indeed, can any two in the whole circle

of

of human employments be more fitly joined: for the ſturdy labouring youth, bred up to ſobriety and rural toil, makes the hardieſt ſoldier; and he who knows the fatigues and dangers of war, chearfully returns to the culture of his farm. Theſe were the men moſt prized by thoſe maſters of the univerſe[a]: and, at this very day, the Arabians, who live under tents in the country, and remove occaſionally from place to place, (a polite people, though ſhepherds, and commonly diſtinguiſhed among us by the ſcornful epithet of wild-Arabs,) deſpiſe thoſe of their nation who live in towns, look upon them as daſtardly and effeminate, and, after having triumphed over them repeatedly, now keep them in ſubjection.

Thoſe who, miſled by wrong ideas too often tacked to words, imagine that a country life is repugnant to politeneſs, are ſurely much miſtaken:---that is the language of falſe urbanity. True politeneſs, the moſt cordial affection, the ſincereſt friendſhip, and unfeigned courteſy, without the grimace of

[a] Viri magni, noſtri majores, non ſine cauſa præponebant ruſticos Romanos urbanis: ut ruri enim, qui in villâ vivunt ignaviores quàm qui in agro verſantur in aliquo opere faciundo; ſic qui in oppido ſederent, quàm qui rura colerent, deſidioſiores putabant.

M. T. VARRO, de re ruſtica, Lib. II.

Hanc olim veteres vitam coluêre Sabini;
Hanc Remus et Frater; ſic fortis Etruria crevit,
Scilicet et rerum facta eſt pulcherrima Roma.

VIRG. Georgic. L. II. v. 532.

ſtrained

ſtrained compliments, have often been found among the labouring rural race, inhabitants of thatched cottages. The appellations of rude and ruſtic were never given to really uſeful occupations, till luxury had debauched mankind, and a frivolous pertneſs uſurped the place of ſenſe and manners. Till then, men naturally eſteemed an Art, of which every day's experience ſhewed them the abſolute neceſſity, as well as the great advantages. If the generality of country gentlemen are reproached with ruſticity of manners, it is their paſſion for ſporting, as they call it, and not their application to Agriculture, which gives them that behaviour.---There would be no room for this imputation, if they were oftener in the field with their workmen, than upon the turf, or in thickets, with their horſes and dogs.

But whilſt I am thus hinting at a part only of the praiſe juſtly due to Agriculture, let me not be ſo far miſtaken as to be ſuppoſed to mean that every man ſhould be a farmer. That might bring us back to barbariſm. It is ſufficient that thoſe who are deſtined to it, be inſtructed and protected; and it will always be right in the Legiſlature to conſider and examine the due degree of eſtimation in which this Art ſhould be held, the juſt hopes that may reaſonably be entertained of it's farther progreſs, and the means by which it may beſt be carried to the greateſt perfection.

By

By a proper application to this moſt eſſential of Arts (cuſtom will not let me ſay, to this moſt important Science), the philoſopher, from whom we muſt expect the greateſt improvements in it, will have a moſt pleaſing opportunity of gratifying his deſire to enlarge his knowledge of nature; the individual, who puts in practice the diſcoveries of the philoſopher, will find the ſureſt way to increaſe his fortune; and the Sovereign, who directs and favours the labours of all, will eſtabliſh his power, independant of all others, upon a foundation which nothing can ever ſhake.

Particular branches of huſbandry have been treated of by many, and ſome very able writers; but no one in our language, except Mr. Worlidge, has even attempted to comprize the whole of this Art, within the compaſs of one work; or to reduce it into a regular ſyſtem, founded on that beſt of guides, experience; which is the deſign of this performance. What renders ſuch a work the more neceſſary, is, that, ſince Mr. Worlidge's time, great improvements have been made in the theory, and much more in the practice of huſbandry, in this kingdom, as well as in the other nations of Europe.

To give the reader the moſt extenſive view of the ſubject, I have conſulted the writers of greateſt character, from the moſt early times, to this; have traced the various improvements made in different ages, and ſe-

lected

lected from the ancients, as well as from the moderns, the moſt improved ſtate of Agriculture, in which I make experiments my chief guide. Where authors of reputation relate ſuch, I give them, though ſometimes contradictory, in order to excite in farmers a ſpirit of making and varying experiments; the only true path to a ſucceſsful practice. I may be cenſured for not determining with greater preciſion, what is right, and what wrong, in theſe inſtances. In anſwer to which I can only ſay, that I thought it more adviſeable to leave the reader to judge for himſelf, after quoting my authorities. I have been particularly careful to collect whatever is new or uſeful in the writings of other nations; thereby to render this work as generally uſeful in all countries and climates as poſſible; and that the rather, becauſe we have now the happineſs of having extended our dominion from the riſing to the ſetting ſun. That boaſt of the Spaniards, that the ſun never ſets on their dominions, is no longer peculiar to them. The practice therefore of the moſt diſtant nations becomes neceſſary in a work intended for a people inhabiting ſo various climates.

In the introduction to this volume, I have ſhewn, that there is not yet one ſyſtem of vegetation, or of aſcertaining the food of plants, which will hold univerſally. It may be obſerved here, as in moſt other diſputed caſes, that each opinion is, in ſome part, founded

founded on truth, and that the error frequently lies in the author's ſtriving to make nature ſubſervient to the principles which he endeavours to eſtabliſh. We ſhall therefore, probably, come nearer to the truth, by blending the different opinions. But as I have avoided entering into theory unſupported by facts, I leave that queſtion undetermined.

Experience ſhews, that the earth, brought to certain ſtates, is always fruitful. I therefore, in the firſt chapter, deſcribe the perfections and imperfections of each different ſoil, and, from the beſt authorities, point out the means of remedying their defects. In this chapter, I have been particularly attentive to the improvement of moors and boggy land: a ſubject hitherto not ſufficiently conſidered by writers on agriculture.

After treating of all the different ſoils in the firſt chapter, I proceed, in the ſecond, to give directions for the management of land, taken in it's natural, uncultivated ſtate. Here I have a guide, in whoſe commendation for his public ſpirit and indefatigable perſeverance enough cannot be ſaid. The Marquis of Turbilly, diffuſing around him the ſweets of Agriculture, has converted a vaſt deſart into fine profitable fields; and rendered all his dependants, from wretched, idle vagrants that they were when he firſt came to the poſſeſſion of his paternal eſtate, induſtrious, eaſy, and perfectly happy in their circum-

circumſtances *. An example well worthy of imitation!

Having brought the land to a ſtate fit for producing crops, I then treat of the culture of corn and pulſe, according to the old and generally received practice. And firſt, as the abſolutely indiſpenſable foundation of huſbandry, I point out the neceſſity and advantages of thorough plowing. As this is, perhaps, the moſt eſſential point of all huſbandry, I have been particularly careful, by a number of inſtances of the advantages of having land in perfect tilth, to call the farmer's ſpecial attention to this ſubject.

The land being prepared for ſowing, I treat fully of the choice and preparation of the ſeed, and point out the ſuperior advantage of ſowing in drills, beyond the common broadcaſt way. I likewiſe give deſcriptions and drawings of the moſt approved inſtruments for that purpoſe, which have yet come to my knowledge.

I next give directions on a ſubject eſſentially neceſſary to the farmer's ſucceſs; *viz.* the judicious change of crops. This has been too little attended to by the far greater number of farmers, to their own coſt and the nation's very great loſs.

I end this volume with directions for the culture of each kind of grain and pulſe, ſeparately.

* See the Marquis's own Account, p. 207.

Encouraged by the very favourable reception which this firſt part of my plan has already met with, I ſhall continue to exert my utmoſt endeavours to render the reſt of this work worthy of the Patronage with which I am honoured, and of the attention of the Public.

THE

THE CONTENTS OF THE FIRST VOLUME.

PART I.

INTRODUCTION. P. 3

CHAP. I.

OF SOILS IN GENERAL, and the means of bringing them to a ſtate proper for the production of plants. 17

§. I. OF STRONG SOILS, and the means of correcting them. 19

§. II. Of the Improvement of SANDY AND LIGHT SOILS. 33

§. III. Of the Improvement of LOAM. 50

ART. I. Of foſſile ſubſtances uſed as Manures. 59

ART. II. Of vegetable Manures. 85

ART. III. Of animal Manures. 98

ART. IV. Of Compoſts. 110

Page

§. IV. Of the Improvement of MOORS and BOGGY-LAND. 123

ART. I. Deſcription of Moors and Boggy-Land. 125

ART. II. Of draining Boggy-Land. 132

ART. III. Of the Improvement of Moors and Boggy-Land. 149

CHAP. II.

Of the breaking up and improving of UNCULTIVATED LANDS. 170

§. I. Of clearing and improving WOOD-LAND. 170

§. II. Of draining and improving MARSHY LAND. 176

§. III. Of breaking up and improving COMMONS and WASTE GROUND. 179

ART. I. The Marquis of TURBILLY's Hiſtory of his Experiments. 180

ART. II. The Marquis of TURBILLY's Experiments in breaking up and improving UNCULTIVATED LAND. 208

CHAP. III.

Of the Culture of Grain and Pulſe, according to the Principles of the Old and the New Huſbandry; with a comparative view of the advantages of each. 250

§. I. OF PLOWING. 255

§. II.

Page

§. II. Of SOWING. 288
ART. I. Of the choice of ſeed. 289
ART. II. Of preparing the ſeed. 293
ART. III. Of the time of ſowing. 311
ART. IV. Of the manner of ſowing. 319
§. III. Of THE CHANGE OF CROPS. 346
§. IV. Of the Culture of GRAIN AND PULSE according to the old Huſbandry. 358
ART. I. Of the Culture of Wheat and Rye. 360
ART. II. Of the Culture of Spring-Corn. 406
Wheat. 406
Spelt. 408
Oats. 409
Barley. 417
Maize or Indian Corn. 431
Millet. 446
Panic. 449
Rice. 450
Buck-Wheat. 456
ART. III. Of the Culture of Pulſe. 458
Beans. 458
Peas. 464
Vetches. 473
Lentils. 481
Lupines. 482

Directions

DIRECTIONS TO THE BOOK-BINDER.

Place all the Plates ſo that they may fold out towards the Right-hand.

The Plates in this Firſt Volume are

Pl. I.	P. 46.
II.	143.
III.	175.
IV.	257.
IV.	265.
V.	268.
VII.	336.
VIII.	346.

N. B. The above irregularity in the numbering of the Plates was occaſioned by a miſtake at the Preſs, which was not noticed till after the ſheets were printed off; when it was too late to correct them: but as all the Plates are paged, their proper places may be eaſily found.

ERRATA.

The Reader is deſired to excuſe and correct, among others, the following Errors of the Preſs.

P. 18. l. 7. *for* of it's own accord, after *read* and, of it's own accord, falls, after

P. 37. l. 8. *for* loom *read* loam

——— 36. *for* ſlack *read* ſlake

P. 100. l. 25. *for* ſhillings *read* pence.

P. 480. l. 12. *for* mixture *read* moiſture.

PRACTICAL HUSBANDRY.

PART I.

Of the Culture of Arable Lands.

INTRODUCTION.

PHILOSOPHICAL inquiries into the principles of vegetation, and the manner in which it is performed, are an object well worthy the attention of gentlemen whose ſituation allows them to purſue that truly uſeful and entertaining ſtudy. But as the induſtrious huſbandman, for whoſe benefit this work is chiefly intended, as a compendium of the beſt practice in Agriculture, founded on the reſult of experience, cannot afford time for matters of ſpeculation; nor would they, in point of prudence,

conſiſt with his neceſſary occupations, even if his education fitted him for ſuch reſearches; it may be ſufficient for him to form a general, but juſt, idea of the means by which plants are nouriſhed. A proper notion of this will help to guide him in the management of his lands, and ſhew him in what ſtate the earth ſhould be, to enable the plants which he cultivates moſt eaſily and readily to find their neceſſary food. This general knowledge of the baſis of Agriculture is even requiſite in every one who would be ſatisfied of the reaſonableneſs of his methods of proceeding, and therefore becomes a proper introduction to the following ſheets.

Whether any one active principle does univerſally nouriſh all plants, or whether ſome particular ſalts or juices feed one plant, and others another, is the great queſtion, upon the clear deciſion of which the whole of the doctrine of vegetation depends [a].

The ancients generally entitled the *Earth* to the production of the animals, vegetables, and other bodies, upon and about it; but ſeveral of the moderns, and among them ſome of very great name, both here and abroad, have declared in favour of *Water*, as the efficient cauſe of vegetation. Lord Bacon was of opinion [b], that, "for the nouriſhment of vegetables, water "is almoſt all in all; and that the earth doth but "keep the plant upright, and ſave it from over-"heat and over-cold." Others carry this hypotheſis ſtill farther; aſſerting water to be the only principle or ingredient of all natural things. They ſuppoſe that, by I know not what proceſs of nature, water is tranſmuted into ſtones, into

[a] EVELYN's *philoſophical diſcourſe of earth, p.* 297. 3*d edit.*
[b] *Natural hiſtory, cent.* V. 411.

plants,

plants, and, in ſhort, all other ſubſtances whatever. Van Helmont, and his followers, to whoſe opinion even the illuſtrious Mr. Boyle has ſhewn a ſtrong propenſity, are very poſitive in this, and alledge, as proofs, the conſiderable growth of mint, and ſeveral other plants, in water, and his well-known experiment on a willow-tree. Van Helmont planted this tree [c], which weighed five pounds, in two hundred pounds of earth dried in an oven, and watered it with rain, or diſtilled water, after carefully covering the caſe in which it ſtood with a perforated tin cover, to prevent the admittance of any other earth. Five years after, weighing the tree, with all the leaves it had produced in that time, he found its weight amount to one hundred and ſixty-nine pounds three ounces; while the weight of the earth was only diminiſhed about two ounces.

Mr. Evelyn thought, with the learned Dr. Sharrok, whom he quotes [d], that water is, of its own conſtitution alone, a ſoil to vegetables, not only as the moſt genuine vehicle of the riches which it imparts to plants, through the ſeveral ſtrainers, and by means of which all change and melioration is effected; but becauſe it is, of all other ſubſtances, beſt diſpoſed for ingreſſion, to inſinuate into, and fertilize the earth; which is the reaſon why floated grounds are ſo remarkably fertile after the flood has ſubſided. "It is," ſays he, "the neareſt of kin to the whole vegetable "race; for to aſſert, with any confidence, what "part of the *meer earth* paſſes into their compo-"ſition; or whether the earth ſerve only for ſta-"bility, or as a womb and receptacle to their "ſeeds, I ſhall not undertake to diſcuſs;---though

[c] DERHAM's *Phyſ. Theol. p.* 61.
[d] *Philoſophical Diſcourſe of Earth, p.* 230.

"I do not yet conceive the earth to be altoge-
"ther ſo dull and inactive, as to afford no other
"aid to the generation of what ſhe bears; the
"diverſity of ſoils being infinitely various, and
"the difference of inviſible infuſions far beyond
"our arithmetic.—But neither do I here by any
"means exclude the air, nor deny its perpetual
"commerce and benign influences, charged as it
"comes with thoſe pregnant and ſubtile parti-
"cles, which pervading and inſinuating into the
"earth's more ſteady and leſs volatile ſalts, that
"inteſtine *fermentation* is begun and promoted,
"which gives life, growth, and motion, to all
"that ſhe produces. Dr. Mayow has proved [c],
"that the moſt exhauſted and worn-out mold is
"repaired by a bare expoſure to the air alone,
"without which it produces nothing. Nor can
"plants, totally excluded from the air, live, or ſo
"much as erect themſelves to any thriving pur-
"poſe, as being deprived of that breath and vital
"balm, which no leſs contributes to their growth
"and nouriſhment than does the earth itſelf, with
"all our aſſiſtance.—Beſides, we find that the air
"is near of kin and affinity to water, and indeed
"ſeems as if it were but a thinner water; for
"how elſe are vines, and other trees of prodi-
"gious growth, maintained among barren rocks,
"and thirſty pumices, where rains but ſeldom
"fall, if not from the benign influences of the
"air?"

To this aerial food and moiſture it is that moſt of the *ſedum* kind owe their growth. Succulent groundſel, and the fragrant wall-flower, draw their nouriſhment from the ſame ſource. An aſh now growing out of a wall of the abbey-church

[c] *Tractat. Medico-Phyſ.*

at

at St. Alban's, affords a remarkable inſtance how much even trees are nouriſhed by the air.

As all kinds of water, as well as air, contain many other ſubſtances beſides the pure elements of water and air, it is difficult to aſcertain whether theſe extraneous ſubſtances, or ſome of them, are not the food of plants. Dr. Woodward's experiments, as related in the Philoſophical Tranſactions†, ſeem to confirm the opinion that they are: for he obſerves, that a great part of what he calls *terreſtrial matter*, mixed with the water in his experiments, aſcended up into the plant, as well as the water; and that the plants were more or leſs nouriſhed in proportion as the water in which they ſtood contained a greater or ſmaller quantity of that matter. With regard to Van Helmont's tree, and the growth of plants in water, he very juſtly obſerves, that nothing like what the advocates for water would infer from thence, can poſſibly be concluded from any ſuch experiments, unleſs the water uſed in them be abſolutely pure, homogeneous, and not charged with any ſort of terreſtrial mixture, to which the plant may owe its growth and increaſe: for that all water, even the cleareſt and moſt tranſparent, does abound with ſuch matter, will appear to any one who ſhall put ſome of the very pureſt into a clean glaſs phial, and ſtop it with the greateſt care. Though perfectly tranſparent at firſt, it will grow cloudy if ſuffered to ſtand ſome time without being ſtirred, and at length depoſit an opaque ſediment. Filtring and diſtilling will indeed intercept ſome of the earthy particles with which it is naturally charged: but neither of theſe operations, nor any other that we know of, tho' ever ſo often repeated, will free it entirely from

† *No.* 253.

all extraneous matter, ſome of which will always remain in it, very fine and light, fit to attend every motion of the water, whoſe extreme tenuity, and exactly ſperical globules, enable it to pervade ſmaller ducts than even imagination can conceive. We hardly know any fluid in all nature, except fire, whoſe conſtituent parts are ſo extremely ſubtile as thoſe of water *. They will paſs through pores and interſtices, impervious to air, or any other fluid. This enables them to enter the fineſt tubes and veſſels of plants, and to introduce the nutritive matter lodged in the earth, conveying it to all parts of them; whilſt each, by means of organs it is endowed with for the purpoſe, intercepts and aſſumes into itſelf ſuch particles as are ſuitable to its own nature: letting the reſt paſs on through the common ducts.

The judicious Mr. Worlidge, uninfluenced by the new and prevailing mode of thinking in his time, according to which all vegetables were ſuppoſed to be fed by water only, declares poſitively §, that he cannot but explode this opinion as deſtitute of foundation; for that, although ſeveral plants ſet in water only, do emit fibrous roots, and flouriſh therein for a time; yet, at beſt, this nouriſhment is but weak, becauſe water does not contain a ſufficient quantity of the true nutritive particles, as the willow, poplar, and other aquatic plants raiſed therein, demonſtrate; and as is ſtill farther evident from their better thriving if the water be often changed. "Ex-

* It is obvious to every one, how eaſily and ſuddenly humidity, or the corpuſcles of water ſuſtained in the air, pervade and inſinuate themſelves into cords, however tightly twiſted, into leather, parchment, vegetable bodies, wood, and the like.

§ *Syſtema Agriculturæ, p.* 4. *3d edit.*

"periments," ſays he, have been made of gourds "and cucumbers, planted in baked earth, and "watered with water only; and after they have "grown to ſuch a bulk as the experimenter "thinks proper, they are weighed, and alſo the "earth, which laſt is probably but little dimi-"niſhed, or perhaps not at all; from whence "they conclude, that the ſubſtance of thoſe ve-"getables proceeded from the water. Thus "have men made experiments ſpeak as they "would have them, to favour the new opinions "they would impoſe on the credulous."

Spring and rain-water contain pretty near an equal charge of vegetable matter; river-water more than either of them. Nor can any doubt be made, but that the water which falls in rain at ſome times, is more charged with particles fit for the vegetation of plants, than that which falls at others. A more powerful degree of heat muſt draw up a larger quantity of that matter, with the humid vapours which form rain, than a more feeble warmth poſſibly can. The water of one ſpring may alſo flow with a higher charge of this matter than that of another: this depending partly upon the quickneſs of the ebullition of the water, and partly upon the quantity of that matter latent in the earth through which the fluid paſſes, and the greater or leſs laxity of that earth. For the ſame reaſon, the water of one river may abound with it more than that of another; and the ſame river, when much agitated, may bear up more of it than when it moves with leſs rapidity.

Though water be not itſelf the food of plants, it is an abſolutely neceſſary agent, by which the matter proper for their nouriſhment, which remains inactive till it be diluted by and incorporated

rated with this fluid, is conveyed to them, and introduced and diſtributed into their ſeveral parts, both from the earth and the air. But ſtill it is not capable of performing even this office, without the concurrent aſſiſtance of *Heat*, which gives it the neceſſary action, exalts and digeſts the nutritive juices, dilates the pores of the plant, and raiſes the ſap into the ſtem, branches, and fruit, where the ſun perfects the work, by ripening it.

The neceſſity of heat in vegetation is apparent from our fields and foreſts, our gardens and our orchards. We ſee that, in autumn, as the power of the ſun decreaſes, ſo its effects on plants diminiſh, and their vegetation ſlackens by degrees. Its failure is firſt diſcernible in trees, which, being raiſed higheſt above the earth, require the moſt heat to elevate the water, charged with their nouriſhment, to their tops and extremities; ſo that for want of freſh ſupport and nutriment, they ſhed their leaves, unleſs ſecured by a very firm and hardy conſtitution, like that of our evergreens. Next, the ſhrubs part with theirs; and then the herbs and lower tribes; the heat being, at length, not ſufficient to ſupply even theſe, though ſo near the earth, the fund of their nouriſhment. As the heat returns with the enſuing ſpring, they all recruit again, and are furniſhed with freſh ſupplies of verdure: firſt, thoſe which are loweſt and neareſt the earth, becauſe they require the leaſt degree of heat to raiſe into them the water with its nutritive charge; next, the ſhrubs and higher vegetables, in their turns; and laſtly, the trees. As the heat increaſes, it grows too powerful, and hurries the ſap with too great rapidity through the finer and more tender plants. Theſe, therefore, go off and decay; and others, which are more hardy and vigorous, and

require

require a greater degree of warmth, ſucceed in their order [h].

Mr. Tull is the only perſon who makes *Earth* the food of plants. The experience of all ages contradicts this opinion; for the neceſſity of inducing ſomething into poor ſoils, to enable them to produce crops, is univerſally acknowleged; whereas, if earth alone was the food of plants, it would in all caſes produce the ſame effect.

As to the grand queſtion, whether plants of different kinds are nouriſhed by one univerſal food, or whether each particular ſpecies imbibes only its peculiar aliment; the ſupporters of this laſt opinion, among whom are the great Lord Verulam [i] and Dr. Woodward [k], ſay, it is not poſſible to conceive that one uniform homogeneous matter ſhould conſtitute bodies ſo unlike in all reſpects as the various tribes of vegetables; nay, even as the different parts of the ſame plant. But a moment's reflection will ſhew, that the latter part of this objection confutes the former; for if the plant has the power of altering the original juices taken in by the roots into ſo many various forms as experience proves it has, each plant may be indued with the faculty of aſſimilating to itſelf the juices it meets with in the earth; as we find the ſame food not only nouriſh different animals, but produce in each its peculiar character.

We have ocular demonſtration, that the willow and alder thrive beſt in a moiſt ſoil, and that the elm, pine, firr, and cypreſs, prefer a drier earth. Yet theſe, and many more of the wideſt difference, are ſometimes ſeen to draw their whole ſuſtenance, bulk, and ornaments, whether annual or perennial, from the juices they find in the ſame

[h] *Dr.* WOODWARD, *Philoſ. Tranſ. No.* 253.
[i] *Nat. Hiſt. cent.* V. 488—495.
[k] *Philoſ. Tranſ. No.* 253.

piece

piece of ground, and from the ambient air and dews; though our ſtricteſt diligence cannot diſtinguiſh the particular aliments which approach their ſeveral roots. Changing the earth about the roots of theſe, or any other trees, whoſe bark, ſap, fruit, and ſeed are of very different kinds and qualities, will only make each tree proſper the better *. "Hence," ſays Dr. Beal †, "we "may juſtly ſuſpect, that the very contextures of "their bodies, from the firſt ſpirting of their "ſeed, and as they are formed gradually from "the inviſible principles or ſpirit and vigour of "their ſeeds, however ſmall and imperceptible, "are the natural alembics, where the common "rain-water and air are digeſted into very much "differing leaves, fruit, ſeed, reſins, gums, &c. "perhaps as the cow's belly converts the com-"mon juices of all ſorts of graſs into milk, or as "the bee collects honey and wax from all ſorts of "flowers."

The ſame ſoil that has once been proper for the production of ſome ſorts of vegetables (continue thoſe who think that each particular ſpecies of plants has its particular food) does not always continue to be ſo; but, in time, loſes its property. If wheat, for example, be ſown upon land proper for that grain, the firſt crop will ſucceed very well, and perhaps the ſecond, or as long as the ground is in heart; but in a few years it will produce no more, if ſown with that corn. Some other it may, as barley, rye, or buck-wheat.

That this is owing to an improper culture of the land, more than to any defect in the ſoil itſelf, will evidently appear to thoſe who ſhall can-

* The reaſon of this will be evidently accounted for by the principles of the New Huſbandry.

† *Philoſoph. Tranſ. No.* 56.

didly

didly weigh the principles of the New Huſbandry, when that ſubject comes to be treated of.

Mr. Du Hamel [m] makes no doubt but that the particles which plants appropriate to themſelves, take different forms in each plant, and even in the ſeveral parts of the ſame plant; but, as he juſtly obſerves, it does not at all follow from thence, that they were not originally the ſame. What would induce one to think them the ſame, is, that plants of different kinds rob one another of the nouriſhment which is in the earth: For, if a lettice, for example, drew from the earth a food different from that of endive, a lettice planted among endive would not only thrive better than if planted among other lettice, but as well as if no other plant was near it. But we know, by experience, that this lettice would grow very poorly, and conſequently that plants, though of different ſpecies, do hurt and rob one another. If each plant drew from the earth only the particular juices proper for itſelf, poppies, thiſtles, &c. which kill wheat, would not, in that caſe, do it any hurt, farther than by ſhading it with their ſtalks. But that the injury they do the corn is chiefly occaſioned by their roots, which conſume the neceſſary nutritive juices, is evident from this; that if dry branches were ſet in ſuch numbers as to make even a greater ſhade than thoſe weeds, they would not equally prejudice the growth of the wheat.

After ſome other arguments of equal force, Mr. Du Hamel concludes, that plants of different ſpecies feed on the ſame, or nearly the ſame ſubſtance; that there is no plant which does not rob thoſe that are within its reach of ſome part of their food; and that the ſoil which once is good for

[m] *Traité de la Culture des Terres, tom.* I. *c.* 4.

any

any one kind of plant, will always be able to ſupply it with food, provided it be properly cultivated.

To prove that the ſame juice takes different qualities in the veſſels of the ſame plant, he inſtances an experiment which he made, by grafting a young lemon, of the ſize of a pea, by the ſtalk, upon a branch of an orange tree. It grew there, ripened, and retained its quality of lemon, without partaking in any ſhape of that of the orange. The juices of the orange tree muſt therefore have changed their nature at once, on their paſſing into the lemon.

It is an old opinion, generally received by the ancients under the name of *occult qualities*, or *ſympathy* and *antipathy*, that ſome plants delight in being near each other, while others will not live together. Several of the moderns have likewiſe embraced this ſentiment, and urge in ſupport of it, the fig-tree and rhue, garlick and the roſe, which, ſay they, agree remarkably well together, becauſe the juices ſuited to the one are avoided by the other. Lavender, laurel, thyme, marjoram, and other aromatic plants, cannot, on the contrary, according to them, flouriſh together, becauſe they feed on ſimilar juices, of which they rob one another. Mr. Evelyn ſeems to be nearer the truth, when, ſpeaking of this ſubject [n], he aſſigns as a reaſon why ſome plants will not thrive near others, certain effluvia or ſteams emitted by the one, which may be noxious to the other. Plants will not thrive under the walnut-tree, the oak, and others of the ſame kind, becauſe their numerous and wide-extended roots exhauſt the earth around them, and the drippings from their

[n] *P.* 310.

leaves

leaves are impregnated with an acrid matter, which is an enemy to vegetation.

Though there are evident inſtances of an election of food in ſome plants of very different kinds, ſuch as the aquatic race, and thoſe which delight in a dry ſituation; yet, ſo far as relates to the farmer, they may be ſaid to be nouriſhed with one and the ſame ſubſtance; but at the ſame time it is neceſſary that both the earth and that ſubſtance be fitted for receiving and nouriſhing them: for be the earth ever ſo good, rich, and proper for the production of vegetables, little will come of it, unleſs its parts have that juſt degree of ſtrength, or coheſion, which ſhall give ſtability to the plant, and at the ſame time afford an eaſy admittance to the fibres of its roots, to ſpread and extend themſelves in ſearch of that food.

In order to give the huſbandman the beſt inſtruction how to obtain both theſe ends, it will be neceſſary to treat particularly of ſoils, and the means of meliorating them.

This laſt is effected by the plough, the ſpade, and the rake; by ſtirring and repoſe; by mixtures of earth, calcinations, and compoſts; and, above all, by the *eye of the maſter, and duſt of his feet*. Too hard and cloſe earth muſt be ſoftened and relaxed; if too looſe, it requires binding; if too light, ballaſt; if too meagre, it ſhould be fattened; if too rich, let it be brought down; if too moiſt, drying manures are proper; if too cold, fermenting compoſts; and if too hot, coolers and refreſhers: "For thus," ſays Mr. Evelyn [o], "earths, being of ſo many different kinds "and natures, ſhould be well conſidered, and

[o] *P.* 311.

"matched

"matched accordingly; things becoming fruit-
"ful from the mixture of contrary qualities."

These subdivisions of different soils, used by Mr. Evelyn, may, with more conciseness, and perhaps greater perspicuity, be ranged under two general heads; *viz.* Those whose particles have too close an adhesion to admit the roots of plants with the ease requisite for them properly to seek their food; and those whose texture is too loose to give the proper stability to plants, or to retain the moisture necessary to convey their nourishment into them. After shewing how both these extremes may be corrected, and brought to a due consistence, little will remain to say in regard to soils, but to point out the means of preserving them in that state, and of providing a constant succession of such matter as experience has taught us tends to render the earth more fruitful, or, in other words, of such matter as contains a supply of the food of plants.

CHAP.

CHAP. I.

Of SOILS in General,

and the means of bringing them to a ſtate proper for the production of Plants.

THE earth which generally preſents itſelf firſt to the eye, is no particular kind of ſoil, but, uſually, a mixture of the ſoil underneath, with every adventitious ſubſtance, either purpoſely brought to, or accidentally lodged upon it. From theſe cauſes, this ſuperficial earth, commonly called mold, grows and increaſes yearly in depth; oftentimes to ſuch a degree, as to form even conſiderable eminences, eſpecially where there has been a fall of woods and trees, ſuch as birch and beech, which, not being of a conſtitution to remain long in the ground without rotting, (as firr oak, elm, and ſome other timber will do,) are pretty ſoon reduced into mold as ſoft and tender as that in which they were ſown or planted.

This ſurface-earth, and alſo the natural under-turf earth, to the depth of about a foot, is generally the beſt and ſweeteſt, being enriched with all that the air, dews, ſhowers, and celeſtial influences can contribute thereto: for that earth is beſt, and it is the ſame with water, which is moſt expoſed to the influences of the ſun and air. The fatneſs of the under-turf earth, drawn up to the ſurface by the kindly warmth of the ſun, ſpends but little of it's vigour in the graſs and tender verdure which it produces (provided no rank weeds be permitted to grow and perfect their ſeeds), but maintains it's natural force, and is therefore, of all uncultivated molds, the moſt grateful to the huſbandman.

As the reſt of the ſubjacent earths approach this in virtue, ſo are they to be valued. Of theſe there are ſeveral kinds, diſtinguiſhable by their ſeveral conſtitutions. The beſt of them is black, fat, and at the ſame time porous, light, and ſufficiently tenacious, without any mixture of ſand or gravel. It riſes in pretty large pieces, of its own accord, after a ſhort expoſure to the air; but without crumbling altogether into duſt, which is the defect of a leſs perfect ſort.

This excellent black mold is fit for almoſt any thing, without much manure. The farmer is not always ſo happy as to meet with it: or if there be a ſmall depth of it, other, leſs fertile, ſoils lie underneath, ſuch as clay, gravel, ſand, &c. which require different treatment, according to their various qualities. Theſe ſoils often appear on the ſurface; and may be ſaid to be almoſt barren, 'till brought by art to anſwer the purpoſes of the huſbandman. In clays and ſtiff ſoils, the component particles have too cloſe an adheſion to admit the roots of plants with the eaſe requiſite for them properly to ſeek their food: and, on the other hand, ſand, and ſoils of a light nature, are too looſe to give the proper ſtability to plants, or to retain the moiſture neceſſary to convey their nouriſhment into them. It will therefore be right, firſt, to ſhew how theſe extremes may moſt properly be corrected, and then to point out the means of keeping the ſuperficial mold in conſtant heart, to uſe the language of farmers.

SECT.

SECT. I.

Of STRONG SOILS,

and the means of correcting them.

CLAYS, which may juſtly be accounted the ſtiffeſt of all lands, are of very different ſorts, and of as different colours. One kind of them is ſo obſtinate, that ſcarce any thing will ſubdue it; and another ſo voracious, as not to be ſatiated without uncommon pains, becauſe it abſorbs whatever is applied, and turns it, to uſe Mr. Evelyn's expreſſion, [p] into as arrant clay as itſelf. Some clays are fatter than others; ſome more ſlippery; all of them tenacious of water on the ſurface, where it ſtagnates and chills the plant, without penetrating; and in dry ſeaſons they harden with the ſun and wind, are very barren, and extremely untractable. The cloſeneſs of clay hinders plants from extending their roots to ſearch for their neceſſary food, and prevents the entrance of water, which would help to convey it to them.

The more unctuous and fat clay frequently lies upon the other, and has often a bed of chalk beneath it: but neither is this worth any thing, 'till it be looſened, and fitted to admit the air and celeſtial influences. The blue, white, and red clay, if ſtrong, are all unkind: the ſtony and looſer ſort is ſometimes tolerable; and the light brick-earth does very well with moſt fruit-trees.

Clay, in general, of whatever kind it be, is, of all earths, the very worſt for vegetation. Yet even this, as well as any other untoward ſoil, may, with induſtry and proper correctives, be made to produce roots and plants which require the lighteſt and holloweſt mold.

[p] P. 209

Clay

Sand

Among all the manures for clay, ſea-ſand claims a preference, founded on experience, as beſt ſuited to break its too great coheſion. River-ſand, drift-ſand, ſmall gritty gravel, lime, rubbiſh of old houſes, chalk, marle, coal-aſhes, and, in general, all calcarious * ſubſtances; are alſo of excellent ſervice, to anſwer the ſame end.

Dr. Cox's accurate account of the ſea-ſand uſed in the agriculture of Cornwall, deſerves particular attention; as a means by which huſbandmen in other parts, eſpecially if their lands be within a moderate diſtance of the ſea, may often reap a very conſiderable advantage, which many of them are too apt to overlook.

"The ſea-ſand made uſe of in the Agriculture of Cornwall, ſays that ingenious gentleman, in a letter to the Royal Society[q], lies commonly at or near the ſhore. To diſtinguiſh it from what is uſeleſs, it is proper to obſerve, that this ſand is formed by the grating of ſtones, ſhells, &c. rolled and tumbled over by the waſh of the ſea. If the matter be *ſhelfy*, as it is called, that is, the rubbing of ſtones only, it is of ſmall value: but if it be notably ſhelly, it is the thing deſired. Of this ſhelly-ſand, there are three colours. About Plymouth and the Southern coaſt, it is *blueiſh* or *grey*, like aſhes: which I conceive to be from the breaking of muſcles chiefly, and oyſter-ſhells mixed with it. Weſtward, near the land's-end, the ſand is very *white*; and in Scilly, *glittering*. This I

* All ſubſtances which burn into lime, and with which acids effervеſce, or riſe in numerous bubbles, are called *calcarious* bodies. They are ſaid to abſorb the acid, becauſe, when mixed with acid or ſour liquors, they attract or ſuck up the acid, and leave the liquor mild and ſweet. Such are marble, lime-ſtone, moſt kinds of free-ſtone, chalk, marle, ſhells, coral, &c.

q *Philoſoph. Tranſact. No.* 113.

think

think comes from the mouldring of moor-ſtones, or a kind of free-ſtone mingled with the white ſhells of the ſcallop fiſh. On the North-ſea about Padſtow, and Eaſtwards to Lundie, the ſand is rich, of a *reddiſh-brown* colour tinged with *yellow*, and conſiſts chiefly of the broken ſhells of cockles; which I gueſs to be of that colour there, from the waſh of the Severn, which falls very dirty into the Severn-ſea."

"Beſides theſe differences in the colour of the ſand, there is alſo another in the bigneſs of the grain. The ſmall is reckoned beſt for the tenant who takes to tillage only for four years; becauſe it works ſooneſt, and yields the moſt ſpeedy return. The larger grain is thought to be more profitable for the landlord, becauſe it abides longer in the ground, and makes the paſture afterwards the richer."

"In Falmouth-haven, near St. Mawe's caſtle, there is a ſort of ſand, or rather *coralline*, that lies about a foot under the Ouſe; which Ouſe being removed, and the bed opened, this ſand is taken up by a dredge, and is uſed about Truroe, Probus, &c."

"Weſt of the mount, in Portcuthnoe-cove, is a large ſhelly ſand. In White-ſand-bay, and about St. Ives, it is very white and ſmall. *"

"About Minver, Perinſand, and Lelant, the ſands are frequently blown up by the wind, and drown abundance of good land. Some houſes, and even churches have been burried in it; nor has any art been hitherto thought of, to prevent its devaſtation."

* The writer of this work is the more particular in his quotation from Dr. Cox's account of ſea-ſand, in Cornwall, as it may help to direct huſbandmen in other parts, how to ſearch for this valuable manure.

"Of all theſe ſands the beſt are accounted, as to *colour*, firſt the *reddiſh*, next the *blue*, then the *white*. As to kinds, the moſt *ſhelly* and the *coralline* are beſt, and that which is taken up from *under* the ſalt-water, either by dredges, or being left open by the ebbing of the tide. The *blown* ſand is accounted of no uſe: and, in genetal, if ſand be only well drained of the ſalt-water, ſo that it may be more conveniently carried, it is better than that which has lain long drying in the ſun and wind, which take off much of its virtue."

"Theſe uſeful ſands are carried by lighters as far up into the country as the tides will ſerve for that purpoſe, and there they are caſt on ſhore. From thence they are fetched, in ſome places, by wheel-carriages; but in moſt, by reaſon of the hilline's, narrowneſs, and badneſs of the ways, on horſe-back; one horſe carrying about thirteen or fourteen gallons. One man drives ſeven or eight of theſe horſes, tail'd together, to the diſtance of nine or ten miles from the ſand-place; and each horſe-load comes to about 8 *d.* or 9 *d.* in ſome places; though not to ſo much in others: for where it is dredged out of the ſea, it coſts but 12 *s.* or 13 *s.* the lighter, (containing ſix-ſcore horſe-loads) at the landing-key, or ſand-place; and where it is loaded from the dry-beach, after the ebb, it is not above 4 *s.* the lighter, excluſive of the land-carriage, which Dr. Cox computes at about 32,000 *l.* a year, in the whole of that country."

"When this ſand is brought home, it is ſpread on the ground intended for wheat; or uſually in the firſt crop of four, whatever be the grain. For after four crops, the Corniſh farmers generally leave their land to paſture for ſix or ſeven years, before they till it again. And indeed, the graſs is ſo good, immediately after tillage, that they commonly

monly mow it the firſt year. This they call *mowing of gratten.*"

"The corniſh acre contains eight-ſcore yards of eighteen feet to the yard. On one of theſe acres, if near the ſand-place, good huſbandmen beſtow three hundred ſacks, or horſe-loads: if within the reach of three turns a day, two hundred; if within two turns, one hundred and fifty; where but one turn can be made, eighty, or an hundred; and ſo in proportion at greater diſtances, even to twenty or thirty ſacks on an acre, rather than none."

"The effect generally is, that where much ſand is uſed, the ſeed is much, and the ſtraw little. Land thus manured, has produced barley, of which the ear has been as long as the ſtalk it grew on. But where leſs ſand is uſed, there is much ſtraw, with but little, and that hungry grain."

Where this excellent manure is found, it is taken up by a large bag of the ſtrongeſt canvas, to the mouth of which is fitted an iron hoop, or frame, to keep it open, and ſink it to the bottom of the ſea, that it may receive the ſand and coral as it is dredged along by the bargemen. The Revd. Mr. Borlace ſays, that a barge-load, which is uſually delivered for 10*s.* or leſs if near the place of dredging, will dreſs an acre, if the land be tolerably good.

Quantities of this ſhelly-ſand, lie neglected on moſt of the coaſts of England. The benefits ariſing from it, particularly when laid upon clayey grounds, are indeed, ſomewhat ſlow; but they are very laſting. The improvement is not the firſt or ſecond year; becauſe this manure conſiſts of hard bodies, ſuch as, the ſand itſelf, the ſhells, fragments of coral, and other calcarious ſubſtances, which require time to diſſolve them, and which afterwards enrich the land for many years. The

beſt is that which is moſt mixed with coral and other ſtony plants. It gives the heat of lime, and the fatneſs of oil, to the land it is laid upon. Being more ſolid than ſhells, it conveys a greater quantity of ferment in an equal bulk; nor does it diſſolve in the ground ſo ſoon as ſhells, but, decaying more gradually, continues longer to impart its warmth, to the juices of the earth.

Similar to this, is the practice of Ireland, in that part of the Bay of Londonderry, called Loughfoil, towards the eaſtern ſide of which lie ſeveral eminences, at about the level of low-water. They are formed of ſhells of ſea-fiſh, particularly periwincles, cockles, limpets, &c. The country people go thither with boats, and take loads of theſe ſhells, which they leave in heaps on the ſhore, 'till they are well drained, and thereby rendered lighter for farther carriage. They then carry them in boats as far as the river will allow, and afterwards in ſacks on horſes, ſix, ſeven, or more miles up in the country. They allow ſometimes forty, but more commonly eighty barrels to an acre. Theſe ſhells agree with boggy, heathy, clayey, wet, or ſtiff land, but not with ſandy. They ſeem to give the land a ſort of ferment, as yeaſt does to bread, opening and looſening the clods, and by that means making way for the roots to penetrate, and the moiſture to enter into the fibres of the roots. This manure continues ſo long, that the archbiſhop of Dublin, from whom this was communicated to the Royal Society, could not find any perſon able to determine the time of its duration.

The reaſon of its long continuance ſeems to be, that the ſhells melt every year a little, till they are all ſpent, which requires a conſiderable time; whereas lime, &c. operates, in a manner, at once. But it is to be obſerved, that in ſix or ſeven years, the ground becomes ſo mellow, that the corn which

grows

grows on it cannot ſupport itſelf, and the land muſt be ſuffered to lie a year or two, that the ferment may be a little quieted, and the clods harden; after which it will bear as long again, and continue ſo to do, with the like intermiſſion, for twenty or thirty years.

The good and laſting effects of ſhelly-ſand for the improvement of clay, afford a ſtrong preſumption that there is an acid in the clay, which the ſhells abſorb or correct: for when that acid is removed, the clay becomes more eaſily ſoluble, or miſcible with water, or, as the farmers term it, is rendered mellow. This is contrary to the opinion of a very ingenious gentleman (Dr. Home) who, becauſe he could not ſeparate an acid from clay, concluded that there was none in it. That the firſt object in the improvement of clay is the deſtroying of this acid, is pretty evident from the qualities of all the ſubſtances uſeful for this purpoſe; every one of them being of the calcarious kind. The tenacity of clay does not ſeem to be owing to the ſmallneſs and unctuous ſmoothneſs of its particles; for in this ſome marles exceed it, and yet are perfectly and eaſily ſoluble in water, probably becauſe they are of a calcarious nature: and if clay be rendered in ſome degree calcarious, by the addition of alkaline or calcarious ſubſtances; ſo long as it continues in that ſtate, it is ſaid to be mellow, that is, it continues fit for the production of plants, till the acid in the air either neutraliſes the alkali, or ſo far impregnates the calcarious ſubſtances, that they can no longer attract the acid. If this be fact, as I believe it is, common ſand can be of little uſe; becauſe the clay will cling as cloſe to a ſtone, or grain of ſand, as it would to part of itſelf, if the ſtone, or ſand, does not ſo far change the body of the clay, as to take off it's tenacity; and therefore Dr. Cox ſeems to be very right

right in ſaying, that the ſand which is formed by the grating of ſtones only, is of little uſe as a manure. However, as ſome eminent writers on this ſubject ſtrongly recommend ſand in general, tho' they all agree in giving the preference to ſea-ſand, it may not be amiſs to hear them.

Columella, ſpeaking in general terms, ſays, that his uncle uſed to carry ſand on clay, and on the contrary, to bring clay on ſandy grounds, with good ſucceſs.

Mr. Worlidge ſays, [s] that the beſt ſand for fertility, is that which is waſhed from hills or other ſandy places by the violence of rain; and that ſands which are dug, have little fertility in them.

Mr. Bradley, after dividing ſand into two general ſorts, as Dr. Liſter does [t], viz. the ſoft, round-grain'd ſand, ſuch as is found in bogs, and hills; and the ſharp or rag-ſand, as it is commonly called, taken from the bottom of rivers, the ſides of highways, or the ſea; adviſes [u] laying even the former on heavy ſoils, eſpecially if it happens to be mixed, as it ſometimes is, with rotted vegetable or animal ſubſtances: to which he adds, that it's efficacy will be increaſed by the addition of ſand of a ſharper nature, about a load of which laſt, if uſed alone, ſhould be ſpread upon every rod of very ſtiff land: for a ſufficient quantity of it muſt be allowed, or elſe the clay will ſoon overcome it.

"The uſe of ſand, ſays M. Miller [x], is to make "the clayey-earth fertile, and fit to feed vegetables, &c. for earth alone is apt to coaleſce, "and gather into a hard coherent maſs, as is ap-

[s] *Syſtema Agriculturæ*, p. 67. [t] *Philoſ. Trans. No.* 164.
[u] *Complete Body of Huſbandry*, p. 84. [x] *Gardener's Dictionary*, Art SAND.

"parent

clay

" parent in clay; and earth thus glued, as it were, " together, is no way diſpoſed to nouriſh vege- " tables: but if ſand, &c. *i. e.* hard chryſtals, " which are not diſſolvable in water, and ſtill re- " tain their figure, be intermixed with ſuch earth, " they will keep its pores open, and the ſoil looſe " and incompact, by which means the juices will " circulate, and plants be nouriſhed thereby. " By means of ſand, the earth is rendered, in a " manner, organical; pores and interſtices, be- " ing thereby maintained, ſomewhat analogous " to veſſels, by which the juices may be convey- " ed, prepared, digeſted, circulated, and at length " excerned, and thrown off into the roots of " plants."

gravel

Small gritty gravel operates in nearly the ſame manner, as an opener of the earth, and is ſtrongly recommended by Mr. Evelyn, Mr. Worlidge, Mr. Bradley, and Mr. King. Good crops have been produced by very ſtiff and ſour land, after it has been manured with gravel, which, to fit it for this purpoſe, ſhould be ſkreened, or ſifted, ſo as to leave among it as few ſtones as poſſible. Sect. 36.

Marle

Shell-marle, or any marle, which makes a ſtrong effervеſcence when an acid is droped upon it, is a particularly good manure for clay; becauſe, diſſolving eaſily in water, it gives a ſufficiently free paſſage to this fluid, by which means the clay is kept dry even in winter: and if the ſoil be of a cold ſour nature, the abſorbent quality of the marle deſtroys that mineral acid, and keeps the ground warm. But as marle in general is more peculiarly uſeful for ſand, a fuller account of it will be given in the next ſection.

The foſſile-ſhells which have been found in ſome countries at a great diſtance from the ſea, are a good manure, if they ſtill retain their quality of ſhells: but beſides their being generally petrifi-

ed, they never are ſo ſerviceable as thoſe which are taken from the ſea-ſhore.

All animal and vegetable ſubſtances are likewiſe proper manures for clay: but as I rank them among general manures, they will be noticed more particularly in the article of loam.

The alkaline * quality of the aſhes of all vegetables, and the calcarious quality of coal-aſhes, render

* If the aſhes of vegetables be diſſolved in boiling water, then ſuffered to ſtand till the earthy parts ſubſide, and the clear liquor be poured off, and boiled to perfect dryneſs in an earthen veſſel; it will leave behind a white ſolid maſs, which is called the *fixed* alkaline ſalt of plants. This is the origin of pot and pearl-aſhes. This ſalt powerfully attracts water from all bodies in which it is contained, and retains it ſtrongly. It acts powerfully on oils, rendering them ſoluble in water; as appears in ſoap, which is compoſed chiefly of oil and this fixed ſalt: and it attracts acids ſtill more ſtrongly than it does water, till, being entirely ſaturated with an acid, it loſes it's qualities as an alkali.

The ſoft, freſh, and juicy parts of vegetables, being thrown into a heap, will ſoon grow warm of their own accord, and continue to ferment, till the whole maſs is brought to an almoſt uniform pappy ſubſtance. It matters not what plants are taken for this purpoſe; for, though they be ever ſo different, the maſs will have a fetid ſtercoracious ſmell, like putrid urine, and a cadaverous putrid taſte. Being chemically analyſed when in this ſtate, they yield a *volatile* alkaline ſalt and ſpirit, perfectly reſembling a ſalt and ſpirit obtained from animals when diſtilled in the ſame manner. This ſalt attracts water ſtrongly, acids ſtill more ſtrongly, and readily unites with oil, which it renders miſcible with water. This putrifaction is general, and converts all vegetable ſubſtances into the ſame matter, how different ſoever they might be at firſt. It makes the whole of them volatile, except a little earth, as we may learn from the fetid ſmell of putrified bodies, which ſpreads ſo wide. As this putrifaction intimately reſolves both the fluids and ſolids, ſooner or later, into a ſoluble maſs; it readily appears, that, by means thereof, and by the aſſiſtance of diluting rains, all things may be returned into the pores of the earth from whence they proceeded: for, if carried up into the air, they are brought down again with the dew, miſt, rain, or ſnow.

Whatever

render them ſingularly beneficial to ſtiff and ſour land, for which purpoſe they are ſucceſsfully uſed in the neighbourhood of ſome great cities where coal is burnt for fuel. They open clayey grounds, and correct their bad qualities. The gardeners and farmers about London, know their value, and make a very profitable uſe of them, particularly to bring into order thoſe grounds which have been dug for brick-earth. After ſpreading theſe aſhes upon the clay bottom, they either ſow horſe-beans, or ſet the early Spaniſh, or, ſometimes, the Windſor-bean, in thoſe ſpots; or elſe they lay ſuch lands down with rye-graſs, which generally ſucceeds very well. Mr. Bradley, blaming the people of Staffordſhire and the counties adjoining, where there are coal-pits, for not improving their many heavy grounds around thoſe pits, by manuring them with coal-aſhes, which might eaſily be burned out of the waſte coal, ſays[y], "that wherever there are plenty of coal-pits, there can be no want of good profitable land." On the ſame principle, we may account for the effects of the calcination of earth, commonly called, *Burn-baking*, or *Devonſhiring*, which will be treated of under its proper head.

Lime, as it is generally uſed, is not found to be of ſo great ſervice in the improvement of clay, as a long eſtabliſhed practice might give room to think, or its qualities reaſon to expect; becauſe

Whatever has a ſour taſte, or effervesces, that is, riſes in numerous ſmall bubbles, when mixed with alkaline or calcarious ſubſtances, is called an acid.

Acids are either mineral or vegetable. Of the firſt claſs are oil of vitriol, ſpirit of nitre, ſpirit of ſea ſalt. Of the vegetable kind, are the juices of all unripe fruits, the watery juices of many plants in the ſpring, and of ſome plants conſtantly, as ſorrel. Of this claſs is vinegar, the only vegetable acid which is the child of art. A vague acid is found every where in the air, as appears by it's ruſting metals.

[y] *Complete Body of Huſbandry*, p. 87.

its

Clay

its particles are so extremely small, that, when separated, or mixed with the clay, they soon become part of its body, and, being so much divided, are speedily saturated by the acid, either in the clay, or in the air. I am therefore strongly of opinion, that the best method of using lime as a manure for clay, is, to spread the lime-stone, unburnt; in which original state acid's effervesce strongly with it, and therefore it will be likely most effectually to mellow the clay. It is likewise, in this it's natural state, attended with the farther advantage of saving the expence of burning, and becomes a very lasting manure; nay, probably a perpetual one, if the stones are broke into small pieces, which is the proper method of using it; as is practised at Horneton in Oxfordshire, where they manure their lands with a sort of soft stone[a], common in those parts; and about Devonshire, where a kind of red rock, very tender, and easily broken into sand, is found to be of extraordinary service to clay, or other stiff soils[b]: for any soft stone, broken small, will be of advantage to cold lands, if laid upon them. [b] We find by Pliny[c], that lime was used as a manure by the ancient Britons, whose lands were thereby rendered extremely fertile.

Mr. Evelyn[d] advises using lime a little slacked for cold, wet grounds, and stiff clays; and observes, that it is apt to over-heat dry soils.

Chalk

Chalk operates in nearly the same manner as lime: but, as Mr. Lisle justly remarks[e], if it be laid on clay, it will, in time, be lost, and the ground will return again to its former condition of clay: as, on the other hand, if clay be laid on chalk, the clay will be lost by degrees, and the

[a] Mortimer's *Art of Husbandry, vol.* I. *p.* 122. [b] Bradley p. 86. [c] *Natural. Hist. lib.* xvii. *c.* 8. [d] *p.* 306.
[e] *Observations in Husbandry, vol.* I. *p.* 66. §. 79.

chalk

chalk regain its former aſcendancy. The reaſon of this, in either caſe, he very rightly takes to be, that either the chalk, or the clay, which ever be the manure, is, in proceſs of time, ſunk very deep into the land on which it is laid, and, being ſoluble by rains into ſmall corpuſcles, is waſhed thro' the ſoil: for neither of theſe manures is able to unite in its fineſt corpuſcles with the corpuſcles of the land on which it is laid, in ſuch manner as to make ſo ſtrict an union and texture with it, as the land does with itſelf, and is therefore liable to be borne down with rains, till no ſign of it be left. * Though it be ſaid in general, that chalking is better for the father than the ſon; it certainly is, on ſome lands, as good an improvement for twenty years as dung; and clayey ſoils have, in reality, always been the better for it.

Gardeners and ſkilful huſbandmen, being frequently aſked by Dr. Beale [e], whether land be moſt fertilized, or moſt ſpeedily, by the influence of the ſun in our climate, or by froſts; generally anſwered, that froſt and ſnow make the quicker diſpatch, and a more extenſive and richer fertility.

On nearly the ſame principle Mr. Liſle adviſes, [f] as a good way to tame harſh, churliſh, obſtinate clay, to turn it up in ridges in the winter, and after the firſt froſt, when it thaws and moulders, to throw in and mix among it aſhes, chalk, or any other ſubſtance that can get admittance into its pores: "for, the time being nickt, wherein "you can catch the clayey corpuſcles under the

* It would rather ſeem, that as ſoon as the acid in the clay, or air, has deſtroyed the calcarious quality of the chalk, this laſt becomes a glutinous ſubſtance ſimilar to the clay, with which it then incorporates.

[e] *Philo. Trans. N.* 56. [f] *Vol.* I. *p.* 26.

"greateſt

"greateſt diſunion and ſeparation, is the time "for keeping them ſo, by mixing with them theſe "other lighter bodies, which will the longeſt pre-"vent their re-uniting."

Another manure for ſtubborn clays, or ſtrong ſoils, much recommended by Mr. Bradley[g], who therein agrees with M. Mortimer[h], is heath-ground, with which, he ſays, the ſtiffeſt ſoil may be brought into ſo good order, that whoever has heath-ground enough, and a ſufficient quantity of clay-ground, may have the beſt land that can be deſired.

Heath may alſo be burnt, and its aſhes, mixed with ſome of the heath-ſoil, be very profitably uſed upon clay. The beſt way of doing this, is to cut up the heath-turf with a breaſt-plough, and burn the heath and turf together. About a buſhel of the aſhes to a load of the heath-ground unburnt, will be of extraordinary benefit to the land.

The turf, or peat, which is dug out of pits, when it has lain a conſiderable while to dry, and is then broken to pieces, is full of ſmall roots, which, when they are expoſed to the air, will rot, and greatly help to temper ſtiff lands. Mr. Bradley, who tried this himſelf, had extraordinary crops, tho' ſome of his land was upon a brick-earth. We may conſider, ſays he [i], that though turfs have been uſed hitherto only for firing, or for building in ſome moory or boggy places, yet they are to be eſteemed as freſh earth, which has lain fallow for many ages; and when they come to be puri-fied by the air and weather, they cannot fail of imbibing a good ſhare of nouriſhment, and of be-ing diſpoſed for vegetation, as much as other earths which are not bound by too many viſcous parts.

g *p.* 89. h *Art of Huſbandry, vol.* I. *p.* 100. i *P.* 89.

But

Sandy and light Soils

But allowing all these methods of improvement their due degrees of merit, I shall conclude this section by observing with Mr. Evelyn [k], that "amongst the mechanical aids wherein stercoration has no hand, that of *pulverizing* the earth "by contusion, and breaking it with the plough "or spade, is of most admirable effect: all dungings and other sordid temperings being but the "*vicars* succedaneous to this improvement, which, "of all others, makes its return of fruit, or whatever else it bears, without imparting any of "those ill qualities, which we sensibly discover in "forced grounds." A truth, which will be evidently demonstrated in the account of the New Husbandry.

[k] *P.* 302.

SECT. II.

Of the Improvement of SANDY AND LIGHT SOILS.

SANDY, gravelly, and other too light soils, easily admit of heat and moisture, but are not much benefited thereby, because they let them pass too soon, and so contract no ligature; producing, to use Mr. Evelyn's words, [a] nothing but moss, and disposing to cancerous infirmities. But if the sand happens to have a surface of good mold, and a bottom of gravel or loose stone, tho' it do not hold the water, it may bear a forward sweet grass; and though it may be subject to burn, yet it quickly recovers with the least rain.

The general defect of these too light soils is, that

[a] *P.* 290.

Sandy & light soils

they neither afford ſufficient ſtability to plants, nor retain moiſture enough to convey to them their neceſſary food. They bring their crops early, and the ſtraw or haulm of the plants growing on them, is very ſhort; but their fruits, or ſeeds, are better ripened, and fitter to keep, than thoſe which are produced by ſtrong lands; becauſe the moiſture of light ſoils being ſooneſt exhaled by the ſun, their productions are the leaſt luxuriant, and contain the feweſt watery particles. For it is a maxim in Huſbandry, founded on experience, that too great richneſs of ground occaſions too great luxuriance in plants, which always is an enemy to the bearing of fruit.

Stiff earth

To bring theſe too open ſoils to a due conſiſtence, that is, to a middle ſtate between ſand and clay, ſome of the ſtiff earths muſt be uſed, in proportion to the degree of lightneſs of the ground they are intended to correct. Meer ſand is too eaſily diveſted of its moiſture and nutritive parts, which, on the other hand, are too cloſely locked up in clay.

Clay & Lime

By the ſame rule that ſand fertilizes ſtrong clayey grounds, clay meliorates light and ſandy ſoils. But, that this manure may have its due effect, it muſt be divided into ſmall particles, ſo as to enable it to incorporate with the light earth. For this reaſon, clay becomes a much better manure when mixed with lime, than perhaps either it or the lime is ſingly. The lime corrects the bad qualities of the clay, and renders it friable.

Mr. Bradley [b] prefers the yellow, red, or white clay, to the blue; though this laſt is of more ſervice to a ſharp ſand, or gravelly ſoil, particularly after it has been dried in the ſun, and

[b] *Complete Body of Huſbandry, p.* 60.

broken

Sandy or light soils

broken to pieces. Of this colour, very ponderous, and not at all ſandy, is the clay Dr. Liſter ſpeaks of [c], uſed for manure in the North-riding of Yorkſhire. The farmers there dry it about Midſummer, on the declivity of a hill, and lay about an hundred loads on an acre of light ſandy ground. They obſerve, that it continues in clods upon the land for three or four years, and that the land manured with it bears rank ill-coloured and broad-grained barley the firſt year, but afterwards a plump round corn like wheat. The good effects of this clay manuring of ſandy ſoils have been experienced to laſt upwards of forty years.

The author of the New Syſtem of Huſbandry, after commending clay as an excellent manure for ſandy, gravelly, pebbly, and other light ſoils, rightly obſerves [d], that it is uſeful only upon lands of a nature entirely different from its own. To theſe it gives coheſion, the only part of excellence they naturally want, and conſequently changes them from what they were originally, to an equal fertility with the beſt and richeſt.

This, ſays he, may ſeem ſtrange to many countrymen, who have bought dung all their life-time to poiſon their lands with: for it is as great folly to dung grounds which require cooling, as it would be to adminiſter poiſon, to cure a man of a fever. Our farmers are not ſufficiently ſenſible, that the temper of land muſt as neceſſarily be conſulted, as the pulſe of the patient. The dunghill is their univerſal refuge, to which they fly upon all occaſions. They miſs a crop by dunging an improper ſoil, and lay on more dung to remedy the misfortune.

[c] Philoſ. Tranſ. No. 225. [d] P. 124.

"Some few years ago, continues he, a friend of mine, remarkably experienced the ſufficiency of this obſervation. He had two fields, divided by a hedge only, neither of which was fit for corn or feeding. He reſolved to improve them both: and when they were plowed up to that intent, he found, that one was a hard brown clay, and the other a very burning gravel. He was ſurpriſed to find theſe diametrical oppoſites ſuch neighbours, and ſuppoſed that the hedge had been formerly made to ſeparate them, for that reaſon. He pulled down the diviſion, and, having laid them open, ſet his men to work on trenching them ſix inches deep. The earth they dug out of one trench in one field, he made them carry inſtantly to another trench in the other field, in wheel-barrows; by this means interchangeably mingling the gravel with the clay, and the clay with the gravel. When this was done, he had it plowed all over with a deep cutting plough, and has ſowed it every ſeaſon ſince, with the richeſt grains. The effect of this is, that he has not now a finer or more mellow piece of ground in his eſtate. The very nature of the land is altered, and there remains no viſible difference between the two diviſions, but the whole is converted into a good hazel-mold, which produces a plump round corn, and as plentiful harveſts as any ſoil in the kingdom."

Two gentlemen of Mr. Bradley's acquaintance had, the one a large piece of heathy or ling ground, and the other a piece of ſtrong clay. They lay contiguous, and were deemed barren lands. He adviſed them [c] to manure one with the other. They did ſo; then plowed them, and ſowed them with barley, which yielded an extraordinary crop. The piece of clay-ground had clover ſown with the

[c] *Complete Body of Huſbandry, p.* 61.

barley,

Sandy or Light Soils

barley, was fed part of the winter, and brought two exceeding good crops of hay the next ſummer. The other bore as fine wheat as any in the country, and afterwards produced good onions, turnips and peas.

Theſe, and ſome other manures, which, being of a more general nature, will be taken further notice of in the improvement of loom, are ſerviceable to ſandy ſoils: but none is equal to marle, of which there are many different kinds and colours, ſeverally diſtinguiſhed by writers on Huſbandry.

Marle

Marle is either grey, blue, brown, yellow, red, or mixed, and is known by its pure and uncompounded nature: beſides which, it is diſtinguiſhed by ſeveral other marks, ſuch as, its breaking into little ſquare bits; its falling eaſily to pieces, by the force of a blow, or upon being expoſed to the Sun or froſt; its feeling fat and unctuous; and its looking, when dry, after having been expoſed to the weather for ſome time, as if it was covered with a hoar-froſt, or ſprinkled with fine ſalt. Even when mixed with the land intended to be manured by it, the whole ſurface of the ſoil will have that whitiſh appearance. But the moſt unerring way to judge of marle, and know it from any other ſubſtance that may reſemble it, is, to break a piece as big as a large nutmeg, and, when it is quite dry, drop it into a glaſs of clear water, where, if it be the right ſort, it will ſoon diſſolve into a ſoft and almoſt impalpable pap, ſhooting up many ſparkles to the ſurface of the water. Some marles effervеſce but little with acids: but they ſhould always be put to that trial; becauſe, the more they effervеſce with them, the more valuable they are as manures. In hot weather, good marle will ſlack with the heat of the Sun, like lime; eſpecially if any rain follows a hot day.

Chap. 49. & 65

Sandy or Light Soils

The farmers in Staffordſhire reckon the ſoft blue marle, which is moſt commonly found under clay, or low black ground, at the depth of ſeven or eight feet, the beſt for arable land, and the grey ſort the beſt for paſture. That which is of a browniſh colour, with blue veins in it, and little lumps of chalk or lime-ſtone, generally lying under ſtiff clays, and very hard to dig, is moſt eſteemed in Cheſhire. The marle which is uſually found at the depth of about two feet, or a yard, on the ſides of hills, and in wet boggy grounds which have a light ſand in them, is very fat and cloſe, and reckoned the ſtrongeſt of all marles; for which reaſon it is particularly good for ſandy lands. This is commonly called peat-marle, or delving-marle. The paper-marle, as it is ſometimes called, frequently lies near coals, and flakes like leaves or pieces of brown paper, than which it is of a ſomewhat lighter colour. That which ſome writers call clay-marle, becauſe it looks like clay, is very fat, and ſometimes mixed with chalk-ſtones. Steel-marle breaks of itſelf into ſquare cubical bits. Theſe two laſt kinds generally lie under ſand or clay; ſometimes about a yard deep under the former, but often much deeper under the latter.

Stone, ſlate, or flag-marle, which is a kind of ſoft ſtone, or rather ſlate, of a blueiſh colour, is generally allowed to be the beſt. It eaſily diſſolves with froſt or rain, is found near rivers and on the ſides of hills, and is a very laſting manure. An ingenious gentleman, whom the writer of this work has the happineſs to reckon among his moſt valuable friends, paſſing lately through Bedfordſhire, obſerved, that the people employed to mend the high-ways, were laying upon them a blueiſh kind of ſtone. Struck with the novelty of the appearance, he ſtopt, took up a lump, and ſoon found it to be this blue marle, which the ignorant peaſants were uſing inſtead of real ſtone.

The

Sandy & Light Soils

The conſequence was, that, when he returned the ſame way ſome time after, a heavy ſhower having fallen, the whole road where this ſubſtance had been ſo injudiciouſly ſpread, was become a perfect quagmire.

Mr. Markham reckons four ſorts of marle, in Suſſex; viz. grey, blue, yellow, and red. The blue is accounted the beſt, the yellow next, and then the grey. The red is the leaſt durable. A great deal of the marle in the North country runs much upon the loams[g]; but that in Suſſex is more like fuller's-earth, and therefore muſt certainly be the fatteſt.

Mr. Mortimer ſays, he ſaw a ſample of marle from Derbyſhire, which was very fat, though it contained ſo much ſand, that, when wet, it could not be worked into a ball, or be made to hold together. This marle did very well upon clayey land, becauſe it was of an opening quality.

In many parts of moſt countries in England, marle diſcovers itſelf to the moſt negligent eye; particularly on the ſides of broken hills, or deep hollow roads. Many rivers are bordered with a vaſt treaſure, which is plundered by every flood. Boggy-lands frequently cover it; and, in them, it ſeldom lies above three feet deep. It is ſome what lower under ſtiff clays, and marſhy level grounds. The loweſt parts of moſt ſandy lands abound with it, ſometimes at the depth of three feet, and ſometimes at ſeven, nine, or more. The depth of the marle itſelf can ſeldom be found; for, when the upper cruſt of the earth is removed, all that can be ſeen, or dug, is marle, to ſo great a depth, that there are few, if any, inſtances of a marle-pit's having been exhauſted.

Nothing is more common than to find the ditches which incloſe a field, dug ſo deep that

[g] MORTIMER's *Art of Huſbandry*, p. 87. edit. 6.

they have penetrated ſix or ſeven inches into a bed of marle, without the farmer's taking any notice of it; though the extraordinary ſhooting and increaſe of the graſs which is put forth by the marle thrown up on the ſides of the bank, might, one would think, be a means of diſcovering it. Where the marle is thus accidentally diſcloſed, it not only turfs the ſides and tops of the banks, and thereby ſecures them againſt all injuries of the weather, but makes the graſs grow ſo long and thick, that, when beaten down by winds, it hangs as if it thatched the earth which nouriſhed it, and carries off the rain, without letting any great quantity penetrate through it.

The marquis of Turbilly, in his excellent directions for clearing and breaking up land, recommends, for boring it (in order to know what different layers of earth, ores, quarries, ſprings, &c. lie underneath, and at what depth, by which means the better jugment may be formed of the plants moſt proper for the ſoil), an inſtrument of his own inventing, as far ſuperior to any thing that has yet been thought of for that purpoſe. A deſcription of it may be of ſervice to every ingenious improver of land.

This *Searcher*, as I ſhall call it, is compoſed of two rods of iron, *Pl.* I. *Fig.* 1 and 2, each ſix feet long, and an inch in diameter. The end *A* of *fig.* 1, ſcrews into the end *B* of *fig.* 2, after taking out the ſtopper *C*, the uſe of which is to hinder dirt or duſt from getting into the ſcrew. The ſcrew is an inch and a half long, and three quarters of an inch thick. *D*, *fig.* 1, is a ſteel point, ſomewhat blunt, to pierce the earth, or any other ſubſtance it may meet with. It ſhould be about three inches long, and made with either three, four, or more ſides, as may be thought moſt proper. It is ſcrewed into the rod *A*, in the ſame manner,

manner, and with a ſcrew of the ſame ſize, as *A* is ſcrewed into the rod *B*.—*E* is a groove ſix inches long, a third of an inch wide, and three-quarters of an inch deep, rounded in the bottom, and intended to bring up part of each different layer through which it paſſes. When ſprings are ſought for, a bit of ſpunge is put into this groove. At the end *F* of the rod *fig.* 2, is a ſcrew to fix into another of the ſame kind, if it be found neceſſary to lengthen the inſtrument; and this may be repeated, by the addition of more rods, to any depth that is deſired.—*GH* (*fig.* 1.) is the handle of this inſtrument, two feet and a half long. This handle is faſtened by a claſp, *I*, lined with ſteel, fixed at one end by a hinge, and at the other by the ſcrew *L*; ſo that it may be placed at any height.—*Fig.* 3. is this handle ſeparated from the rod, and marked with the ſame letters as before. The uſe of the handle *fig.* 4, alſo marked with the ſame letters as the former, is, to ſcrew and unſcrew the ſeveral pieces of the rod, and to keep it ſuſpended, if that be at any time thought proper, as it is drawing out of the earth; for it muſt be drawn out from time to time, to examine the ſubſtance contained in the groove; and if it ſhould chance to drop down to the bottom of the hole after ſome of the upper joints have been taken off, the recovering it again might be attended with conſiderable labour and expence. The handle *G H*, *fig.* 1, is that by which the rod is held, and worked into the earth, either by twiſting it round, eſpecially at firſt, or, after it has penetrated to ſome depth, by lifting it up and letting it fall again, which it does with ſuch force as to pierce even the hardeſt rock; eſpecially if it works at any conſiderable depth, and has of courſe been lengthened accordingly; for every foot of this rod weighs three pounds. Two men will eaſily

found the depth of twelve feet in leſs than a quarter of an hour, if they do not meet with many ſtones. When the rod becomes too heavy to be properly managed by hand, it may be raiſed by a rope faſtened at one end to the handle, and at the other to a roller, or kind of winlaſs, erected at a proper height, perpendicularly over the hole, and turned with either one or two handles. This will coſt but a trifle, and will eaſily raiſe the rod, which, when let go, will fall with ſuch weight as to ſtrike each time very deep into the earth. M. de Turbilly has ſeen it worked in this manner to the depth of upwards of an hundred feet.

The toughеſt iron is beſt for making this inſtrument, which ſhould be well hammered, till its ſurface be quite ſmooth and even; for the leaſt roughneſs or inequality, would occaſion a friction which would greatly impede its working. For the ſame reaſon, and that its fall may be the more forcible, it is likewiſe neceſſary that it be perfectly ſtraight: neither ſhould it ever be ſtruck with a mallet, hammer, or otherwiſe, to force it down; becauſe a blow might bend it, and it would eaſily break afterwards. The female ſcrew muſt be turned, like the ſcrew in the barrel of a gun, in a ſeparate piece of iron, croſs-ways to the grain (for iron, ſays Mr. de Turbilly, has a grain, as well as wood), and this piece muſt be afterwards well ſoldered on to one of the ends of the rod. The reaſon of this is, that if the female ſcrew were bored only at the end of the rod, when hammered out, in the ſame direction as the grain, it would be ſtringy and porous, and conſequently ſo weak as to give way, or burſt, in the working of the rod; whereas, when made of a ſeparate piece, taken croſs-ways of the grain, the turnings of the ſcrew will run with the grain of the iron, and be thereby conſiderably ſtrengthened. A bit, like that of an

augur,

augur, proportioned to the thickneſs of the rod, may, at any time, be ſubſtituted inſtead of the ſteel point, to draw up a ſample of the ſubſtance from the very bottom of the ſounding. M. de Turbilly made his firſt *ſearchers* two inches in diameter; but found afterwards that they were ſufficiently ſtrong, and worked better, when but one inch thick. If the only thing wanted be, to know the nature of the under-ſoil, and layers of earth, ſo far as they may affect the vegetation of plants, it will be very ſufficient to bore eight or ten feet deep. A greater depth is requiſite only when water, ore, or other foſſils, are ſought for. I have been the more particular in copying the Marquis's account of this inſtrument, as he aſſures us that many years experience have ſhewn him its great utility; and in hopes that every intelligent ſmith will be able to make it from this deſcription *.

The common augurs do very well for ſhallow boring, that is to ſay, not beyond the depth of eight or ten feet. One of theſe may be about three feet long, another ſix, and a third ten. Their diameter ſhould be near an inch, and their bits large, and tenacious of what they pierce. An iron handle ſhould be fixed croſs-ways to each, to wring it into the earth, from whence, like M. de Turbilly's *ſearcher*, it muſt be drawn up as often as it has pierced a new depth of about ſix inches, to cleanſe and examine the bit. But for ſounding deep, this laſt is undoubtedly the proper inſtrument.

By one or other of theſe means, there is a certainty of diſcovering, without much charge or any hazard, not only what earths are under the upper

* The price of it, in France, is half a crown a foot, including the handles and other neceſſary pieces.

ſoil but whether any other thing of value lies concealed there, ſuch as marle, chalk, fuller's-earth, coals, quarries of ſlate or ſtone, ores, &c. many of which are hid, and quite unthought of, in places, where their value, was it known, is ten times more than that of the whole eſtate which covers them.

The author of the New Syſtem of Agriculture relates [s] on this occaſion, a ſtory of a Dutchman, who was caſt away upon the coaſt of Norfolk, and carried before a juſtice of the peace, who, underſtanding that he had ſkill in draining, took him one morning into a field where he had begun a work of that nature. The Dutchman perceived a whiteiſh kind of earth, which had been thrown out of one of the trenches, and examined it with great attention. The juſtice aſked him, if it were of any value in Holland? The ſailor anſwered, that it was ſold at an extraordinary price in his country; that it came down to Rhine, to Delft and other places, from a village about twenty miles above Frankfort, and was uſed for making the fineſt ſort of earthen-ware. The juſtice, thereupon, ſent a ſample of it to Holland, and finding the matter exactly as it had been repreſented, became a merchant of this product of his own land, by which he got ten thouſand pounds in a few years.

Though, as was obſerved before, a marle-pit can hardly be exhauſted, yet, the digging of it too deep in level lands inclinable to wetneſs in the winter, is ſometimes attended with this inconvenience, that ſprings break into it, which increaſe the labour of the workmen, and conſequently the expence. To remedy this, Mr. Mortimer propoſes one of the ſimpleſt, cheapeſt, and beſt pumps ever yet invented for this purpoſe. It is made of four deals, or other boards, which joint and nail

[s] *P.* 118.

well

well together; and if ſome plates of iron be nailed over their edges, it will ſtrengthen them much. Theſe pumps may be made ſingle, with a common pump-handle to them, to be worked by one man, or double, for two men, as in *Pl.* I. *fig* 5.—*a a* ſhews the cylinder of the pump, which is of equal ſize throughout. A little above the extremity, *B*, an aperture is made at *C*, to receive the water. The placing of the aperture there, will prevent grit, dirt, or mud, from riſing in the pump, and choaking it; which they would be apt to do, if the opening was quite at the bottom of the cylinder, as is miſtakenly directed in the deſcription of Mr. Mortimer's pump [h]. At *D* is a ſpout, through which the water is diſcharged. Mr. Mortimer directs a bucket, fitted to the cylinder of this pump, with a valve at the bottom of it, which opens and ſhuts as the bucket is moved up or down. Inſtead of that, I would recommend a ſucker, commonly uſed in Cornwall, for ſuch ſquare pumps, made in the following manner.

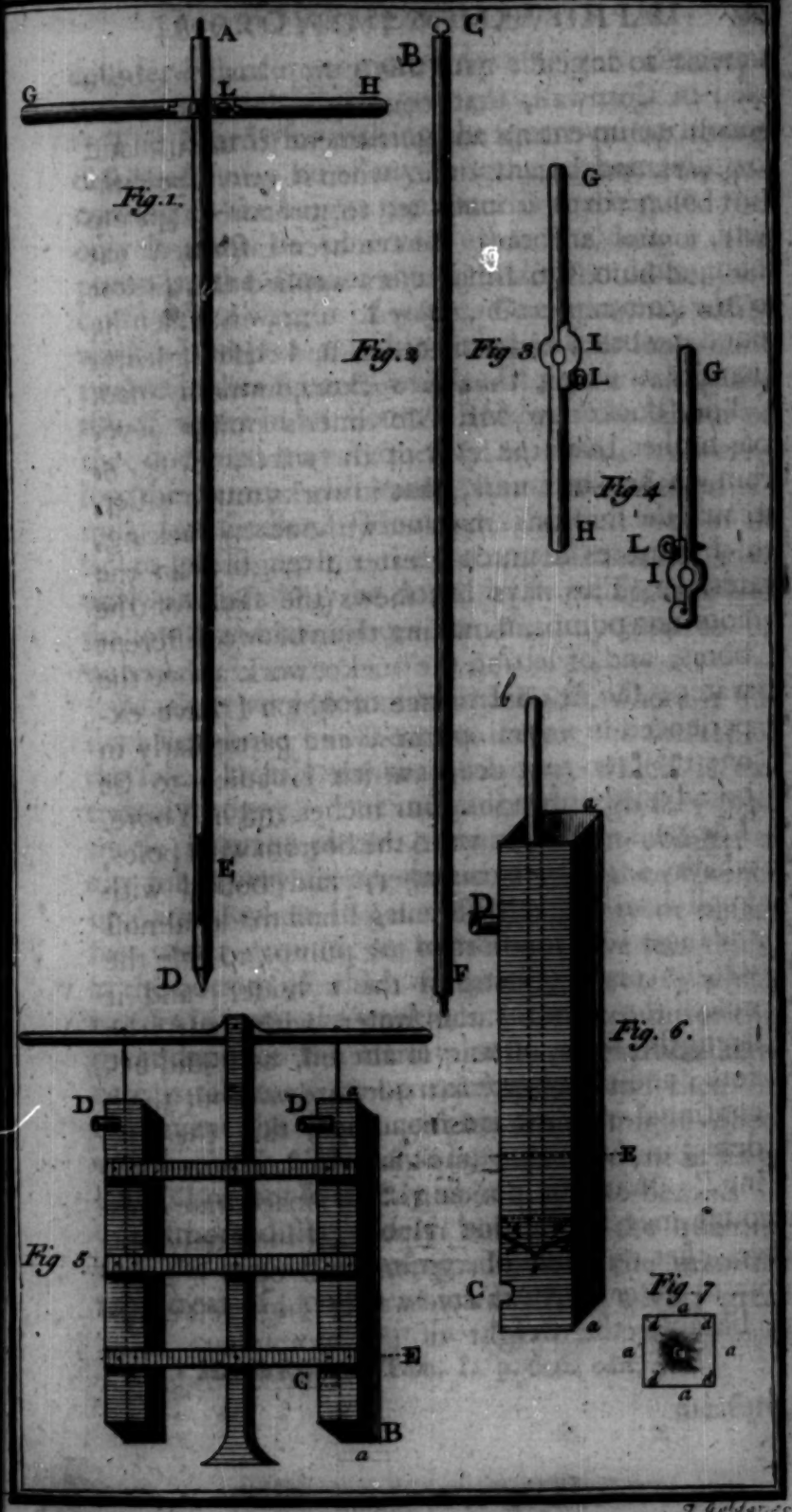
The lower end of a wooden rod, which, becauſe of its lightneſs, is preferable to iron, is cut with four equal ſloping ſides, terminating in the point *c*, *fig.* 6 and 7, *Pl.* I. To theſe ſloping ſides, each of which forms a triangle, are fixed four pieces of leather, likewiſe cut in a triangular form, large enough to fill the cavity of the pump when fitted to the end of the rod, and ſewed together, as at *d d d d*, *fig.* 7. When the rod *b*, *fig.* 6, deſcends into the water *E*, the ſides of this leather will collapſe, as at *e e*, and by that means afford a ſufficient paſſage for the water to aſcend. The moment the rod is raiſed, the weight of the incumbent water will diſtend the leather, in the directions *d d*, ſo cloſe to the ſides of the pump that no

[h] *Vol.* I. *p.* 90.

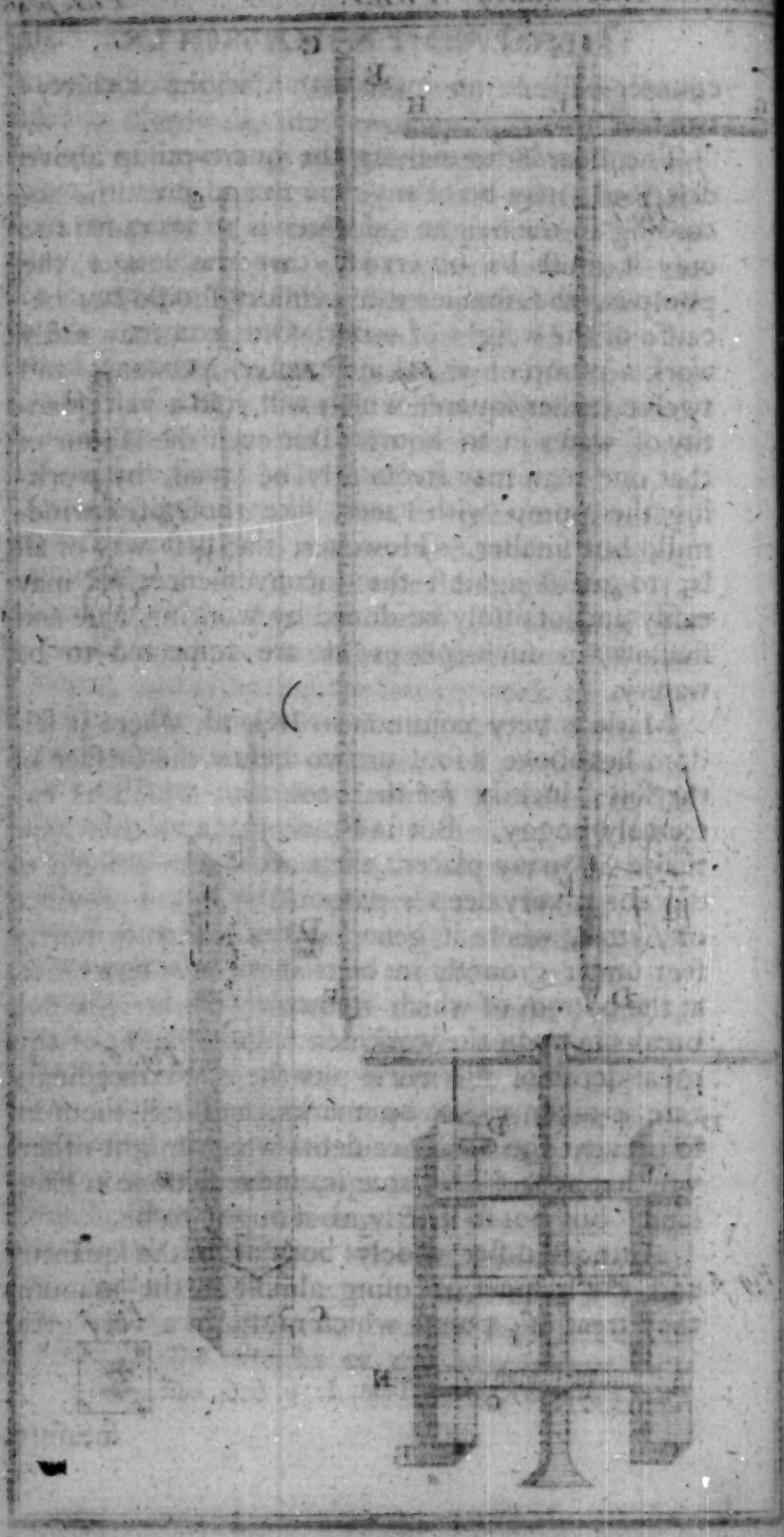
water

water can deſcend. As this pump has long been uſed in Cornwall, that country is intitled to the honour of inventing an inſtrument ſo uſeful, and ſo eaſily made at any time, when it might be difficult, or perhaps impoſſible, to procure a pump with a circular bore. I have been informed that the ingenious Dr. Deſaguliers applied this ſucker to the common round-bored pump, in which he found it work with leſs friction, and raiſe a greater quantity of water, than the ſucker commonly uſed.

The bucket in Mr. Mortimer's pump never roſe higher than the level of the water, *E*, *fig.* 5. from whence he infers, that it works much eaſier, becauſe the motion is in water without any ſucking, which requires a much greater ſtrength than the water. "This, ſays he, ſhews the fault of the "common pumps, in making them of two different "bores, and of letting the bucket work above the "water; the ill contrivance of which I have ex- "perienced in ſeveral pumps, and particularly in "one of ſixty foot deep, which I cauſed to be "bored quite through, four inches and half bore. "The bucket I let down to the bottom with poles, "which I grooved together, and bound with "ſmall iron bands: the poles I had made almoſt "the bigneſs of the bore of the pump, to eaſe the "weight of the water in the cylinder; and it "raiſed three times the water with half the "ſtrength, when it was ſo altered, as it did be- "fore; and the pumps ſo made, are without thoſe "continual repairs and mendings, that the leaſt "defect in ſucking pumps are conſtantly requir- "ing." Without noticing how inaccurate this account may be in other reſpects, I ſhall only obſerve, that no valve of a pump will open if a column of water above thirty two feet high reſt upon it; becauſe the weight of the atmoſphere will counter-


A
B
C
G
L
H
Fig. 1.
Fig. 2
Fig 3
I
L
G
Fig 4
H
L
G
I
E
D
F
b
a
D
Fig. 6.
E
C
a
Fig 7
a
a
a
a
D
D
a
Fig 5
E
C
B
a

J. Golder sc.



Sandy or Light Soils.

counter-balance no more than a height of thirty-two feet.

The boards for making the ſquare-pump above deſcribed, may be of any length and breadth, according to the height the water is to be raiſed to: only it muſt be obſerved, that the longer the pump is, the ſmaller the cylinder ſhould be, becauſe of the weight of water. One man may eaſily work a pump of this kind twelve feet long, and twelve inches ſquare, which will void a vaſt quantity of water in an hour. But even the labour of that one man may frequently be ſaved, by working the pump with vanes, like thoſe of a windmill, but ſmaller. However, the beſt way of all is, to guard againſt the inconvenience, as may eaſily and infallibly be done, by working wide and ſhallow in ſuch places as are ſuſpected to be watery.

Marle is very common in Ireland, where it ſeldom lies above a foot or two below the ſurface of the ſoil; luckily for that country, which is extremely boggy. But in France, though they have marle in many places, they are often obliged to dig for it very deep [i], particularly in the province of Artois, where it generally lies eighty or ninety feet under ground, in beds about five feet thick, at the bottom of which frequently is water, which breaks in upon the workmen. On account of this great depth of the marle-pits there, extraordinary care is taken to ſet up marks, and rail them in, to prevent the fatal accidents which might otherwiſe happen. The ſame is, indeed, done in England; but not ſo ſtrictly as it ought to be.

Marle continued.

Authors differ widely both as to the quantity and the manner of uſing almoſt all the manures they treat of; points which muſt, in a very great

[i] *Maiſon Ruſtique.* Tom. I. p. 606. edit. 7.

meaſure,

Sandy light soils.

measure, depend on the quality of the soil, and the strength of the manure, of whatever kind it be, and in which experience will ever be the judicious farmer's surest guide. In marling, it is particularly necessary to find the true proportion which the land requires, and better to err in laying on too little, than too much; because, more may be added at pleasure; whereas, by over-doing it, the first year's crop often fails, because the body of the marle has not been sufficiently opened; and, in that case, it will sometimes be two or three years before the ground comes to a proper temper. The best directions that can be given to the farmer in the application of this manure to light soils, is, to lay on the quantity which will give the degree of cohesion wanted in those soils. A general rule cannot be laid down in this respect, because, the quantity of marle requisite to effect the desired end, must be different, in proportion to the degree of lightness of the soil.

Pliny[k] speaks of marle as a species of improvement known to the Greeks, but more peculiar to Britain and Gaul. He calls it, the fat of the earth, and compares it to the glands in the human body, which are lapped in a coat of fat. As this manure, so far as we can find, was not used, and probably not to be found, in Italy; it shews how attentive the Romans were to agriculture, wherever they carried their victorious arms; since, notwithstanding the continual alarms they lived in from the natives here and in Gaul, they found time to discover and perfect a means of improving land, particularly suited to the soil and climate, and, of all others, the cheapest and most lasting.

[k] *Lib.* xvii. *c.* 6 & 7.

Before

Sandy or light soils

Before I quit this ſubject, I muſt obſerve, with Dr. Home[1], that a body very ſimilar to marle in its appearance, but eſſentially different in its effects, is often found in the ſame bed with the beſt marle. It is of a darkiſh lead-colour. Inſtead of fertilizing the earth, it renders even the beſt ſoils incapable of bearing any kind of vegetables for many years. I have ſeen, ſays that gentleman, the ſpots on which it was laid, entirely barren three years after, and have heard of its bad effects continuing in other places for a much longer time; nor is it certain when they will ceaſe. A body ſo very deſtructive to agriculture, deſerves to be well characterized, in order to its being ſhunned; and ſhould be thoroughly examined, that we may know whence proceeds this noxious quality, and how to cure it when it has taken place.

Marle takes a ſmooth poliſh from the inſtrument with which it is wrought. A piece of this taken up, when it has not been much expoſed to the influence of the air, differs greatly in taſte from marle. Inſtead of the ſmooth unctuous taſte of the latter, it is acid, and remarkably aſtringent. It agrees with marle, in crumbling in water, but differs remarkably from it in not raiſing any effervescence with acids, nor in the leaſt deſtroying their acidity. It turns the ſyrup of violets red; which ſhews that it contains an acid: whereas marle, like all abſorbent earth, gives it a green colour. The trying of marle with acids is therefore the more neceſſary, to guard againſt uſing this pernicious ſubſtance. See p. 37.

It appears from experiments made by the doctor, that this pernicious ſubſtance conſiſts of an earthy body like clay, about an eighteenth part of ſalt of

[1] *Principles of Vegetation, p.* 57.

Loam

ſteel, and a ſmall proportion of the vitriolic acid: from whence he concludes, that good marle is the proper cure where this noxious earth has been inadvertently uſed; becauſe it corrects the acid, and decompoſes the ſalt.

SECT. III.

Of the Improvement of LOAM.

HAVING pointed out the means of bringing the extremes of clay and ſand to that due conſiſtence, which fits them for the production of plants; the next thing to be conſidered is, how the earth may be beſt kept conſtantly in that ſtate, proper to bear whatever crop the farmer's intereſt, or inclination, may lead him to cultivate. This end is obtained by the application of ſuitable manures, and by due culture, each of which will be treated of ſeparately, after mentioning what it is neceſſary the huſbandman ſhould previouſly know, the ſigns by which he may diſcover the quality of the ſoil before he breaks it up, or at leaſt before he ſows it.

The Romans, who were very attentive to this circumſtance, diſtinguiſhed three general ſituations of land; champaign, hilly, and mountainous. They rightly approved moſt of a champaign country declining gradually from the foot of a hill towards the ſouth, or ſouth-eaſt; of a hill riſing gently; and of a mountain neither lofty nor rugged, but covered with plenty of wood and graſs[a]. Either of theſe ſituations is eligible, according to the

[a] CATO, *de Re ruſtica, Lib.* I, *c.* 1. VARRO. *Lib* I. *c.* 7. COLUMELLA, *Lib.* II. *c.* 2.

purpoſe

purpoſe for which the ground is intended; [b] ſome plants affecting hotter, others colder expoſures; ſome delighting to dwell on hills, others in vallies; and ſome again being indifferent to either: but, generally ſpeaking, moſt vegetables chooſe the warm and kindly ſoil of low grounds, fertiliſed by what the rains bring down to them from the hills and more elevated parts.

The ſpontaneous produce of the earth is an infallible indication of the nature and quality of the ground. Wild thyme ſhews it to be good for feeding cattle; betony and ſtrawberries direct to wood; camomile points out a mellow ſoil fit for wheat; burnet indicates land fit for paſture; and mallows denote it proper for the uſes of the kitchen-garden, as has been obſerved by Lord Bacon[c], Mr. Evelyn[d], and others.

On the contrary, ſays the laſt mentioned of theſe writers, ſome ground is ſo cold as naturally to bring forth nothing but gorſe, broom, holly, yew, juniper, ivy, box, &c. which may perhaps direct us to the planting of pines, firs, and other perennial verdures in ſuch places.

Moſs, ruſhes, wild tanſy, ſedge, flags, fern, yarrow, and withered, blaſted, ſhrubby and curled plants, are natural indications of a very bad ſoil.

The nature of the ground may alſo be pretty well gueſſed at, by the quality of the *water* which runs, or is ſtrained through it[e].

By the *ſmell*, which, upon the falling of the firſt rains after a long drought, is very pleaſing, and even fragrant, from good and natural mould; but diſagreeable and noxious if the ground contain any mineral, or other ill quality, as is remarkable in marſhes and fenny places.

[b] EVELYN, *Philoſophical Diſcourſe of Earth*, *p.* 292.
[c] *Natural Hiſtory*, Cent. VII. 660. [d] *p.* 92.
[e] *Idem*, *ibid.*

Loam By the *taſte*; all earths, as well as plants, abounding more or leſs in their peculiar ſalts; ſome ſweet and grateful; others bitter, hot or aſtringent; and others flat and inſipid; eaſily diſcovered by the method which Columella directs[f], of digging up ſome of the under mould, out of that part of the land which is deemed the worſt, and mixing it thoroughly in an earthen veſſel, with ſweet water, which, when poured off after the groſſer parts have ſubſided, will retain the taſte of the earth ſoaked in it.

The *touch* will immediately ſhew whether it be ſoft, pliant, fat and ſlippery; whether it ſticks to the fingers, or melts and diſſolves on the tongue; in which caſe the ſoil may be deemed rich. If it be gritty, light, and porous, it is bad.

Mould fit for the production of plants is of an uniform ſubſtance, unmixed with the contrarieties of ſoft and hard, churliſh and mild, moiſt and dry: neither is it too unctuous or too lean; but light, and crumbles eaſily; yet is conſiſtent enough to be wrought and kneeded. It is of ſuch due tenacity as to retain a juſt degree of moiſture, and neither ſoils the fingers, nor cleaves much to the ſpade, which eaſily enters it. Of this kind is the ſoil uſually found under the turf of paſture grounds, upon which cattle have been long fed and fodder-ed. In ſhort, that is the beſt mould which is blackeſt, cuts like butter, ſticks not obſtinately, breaks into ſmall bits, ſmells ſweet, is tempered without cruſting or chopping in dry weather, or becoming poachy in wet, which ſhines after the plough, where flocks of crows follow the plowman, and, as, Pliny expreſſes it[g], peck at his very heels.

As to *colour*, next to the blackiſh, the pre-eminence is generally given to the darker gray, and

[f] *Lib.* II. *c.* 2. [g] *Lib.* xvii. *c.* 5.

after

after that to the ruſſet: the clear tawny is reputed worſe; the light and dark aſh-colour (light of weight and reſembling aſhes) good for very little: and the yelloviſh red, the worſt of all.

The common opinion, that all hot grounds are red or brown; cold and dry, blackiſh; cold and moiſt whitiſh; hot and moiſt, ruddy; is, notwithſtanding the ſpecious arguments alledged in favour of it, from the exhalation of minerals, the heat of the ſun, and other accidents, exploded by Columella, who propoſes[g], as a much ſurer way to judge of the goodneſs of land, digging a trench, and afterwards throwing back the ſame earth that was dug out, treading it down well when it is returned. — If, ſays he, through a kind of *ferment* as it were, there be more than enough to fill the trench, it is a certain ſign that the ſoil is fat*: if there be not enough, we may be ſure that it is poor and lean; and if the quantity be juſt ſufficient to fill the hole from whence it was taken, it is of a middling quality.

Mr. Evelyn, after examining the component parts of ſeveral ſorts of ſoils, concludes[h], that the very fineſt earths and beſt moulds, however to appearance mixed with divers imperfect bodies, may, for aught we know, conſiſt more of ſandy particles, than of any other whatever. Hence he infers[i], that earth, ſtript of all heterogeneous particles, retains only weight, and an inſipid ſiccity; and doubts whether it afford any thing more than embracement to the firſt rudiment of plants, protection to the roots, and ſtability to the ſtem; being "unprolific till married to ſomething of a "more maſculine virtue, which irradiates her "womb: but otherwiſe, nouriſhing only from

g *Lib.* II. *c.* 2. * Dr. HOME judiciouſly obſerves, that the ſwelling of rich earth, when dug in the manner Columella mentions, is owing to a ferment raiſed by the putrid particles mixed with the ſoil. h *p.* 294. *and* 295. i *p.* 298.

"what is added, without any action or material "contribution: — for," says he[k], "what gives "the divers tempers to moulds, seems rather to be "caused by the perpetual and successive rotting "of vegetable and animal substances, than by "any peculiar and separate principle; the *clam-* "*mineſs* of the earth seeming rather something "extrinsical and accidental to it, than natural and "originally constitutive. — We know indeed[l], "that the earth is, without any artificial auxiliaries, "indued with a wonderful prolific virtue: but as "this is liable to be lost, or to decay, and never "can be expected from some grounds, without "helps; it may be worth our while to consider, "by what expedients the desired effect of perpe- "tuating it's vigour may best be accomplished."

The means of giving and perpetuating this vigour now becomes properly the subject of our farther inquiry, consistent with what was observed before, that in order to the earth's having this vigour, it should be constantly kept in an alkaline or calcarious state. Mr. Evelyn is clearly of this opinion, when he says[m], "I firmly believe that "were salt-petre to be obtained in plenty, we "should need but little other compost to me- "liorate our ground." In other words, could the earth be always kept in a state fit for collecting nitre, it would consequently be always in a state fit for the production of plants. They who are acquainted with chemical researches, know, that nitre is obtained from substances of a mixed nature. It's basis is a calcarious earth, to which must be added putrid or alkaline substances, especially of the vegetable kind.

Mr. Evelyn and some later writers have spoken so much of the effects of nitre, and nitrous earths,

[k] *p.* 295. [l] *p.* 312. [m] *p.* 315.

in

in vegetation, that many have imagined nitre to be eſſentially neceſſary in the growth of plants: though Dr. Woodward aſſures us [n], that, by all the trials he has been able to make, the very contrary ſeems to be the caſe; for that nitre, when contiguous to a plant, rather deſtroys than nouriſhes it. When, therefore, they mention nitre, and nitrous earths, it is more than probable that they mean earth in a ſtate fit for collecting nitre: — But when the alkaline ſubſtances are once ſaturated by the acid in the air, or when the alkali is brought to a neutral ſalt, as nitre is, it's fertile ſtate then ceaſes, and it becomes a hard compact body, much more impervious to the roots of plants, than it was before.

The nature of calcarious ſubſtances, and that of the two kinds of alkalis, *viz.* the fixed alkaline ſalt of plants, and the volatile alkali ariſing from animal and putrid vegetable ſubſtances, has already been explained [o].

Farmers commonly ſay, that lime (to which might be added all other calcarious ſubſtances) does not fatten, but only mellows the earth; meaning, according to Dr. Woodward, that it does not contain in itſelf any thing of the ſame nature with the vegetable mould, or, in other words, afford any matter fit for the formation of plants; but that it only ſoftens and relaxes the earth; by that means rendering it more capable of entering into, and of nouriſhing the ſeeds and vegetables ſet in it, than it would otherwiſe be. It is well known how apt lime is to be put into a ferment and commotion by water. Now this commotion can never happen when the lime is mixed with earth (and it retains its quailties of lime,) however hard and clodded the ground may be, without opening and looſen-

[n] *Philoſoph. Tranſ. No.* 253. [o] *page* 20 *and* 28.

ing it. What Doctor Woodward ſays of ſalt in general, may more properly be applied to the fixed alkaline ſalt of plants. Every one, ſays he, muſt have obſerved, how apt all ſorts of ſalts are to be wrought upon by moiſture, and how eaſily they melt and run with it. When this happens to thoſe that are in the earth, the clods which they are mixed with, moulder and fall aſunder. The ſame Gentleman farther obſerves, that if we would render the earth truly fruitful, it muſt be by the addition of ſuch ſubſtances as former crops have robbed it of, or ſuch as contains in itſelf vegetable matter.

Vegetable & animal ſubſtances.

The ſeveral manures which are found beſt to promote this end, are chiefly, either parts of vegetables, or of animals; of animals, ſays the Doctor, which either derive their own nouriſhment immediately from vegetables, or from other animals that do ſo, and which, being returned to the earth, ſerve for the formation of other ſimilar bodies. Theſe vegetable and animal ſubſtances, are the matter from whence Mr. Evelyn thinks the earth derives that *clamminess* which he takes to be a ſure indication of a rich ſoil.

If the effects of the putrefaction of vegetable or animal ſubſtances, when mixed with, and ſeparated in the earth, be duly attended to, we ſhall find this a very probable opinion. Vegetables, or animals, if expoſed to the air, ſoon putrify and fly off into the air: but when they are divided into ſmall portions, and mixed with the earth, the earth renders the progreſs of their putrefaction ſlower, and intangles the volatile alkaline particles, which would otherwiſe fly off into the air. Theſe are not only ſtrongly attractive of moiſture, but, like the fixed alkali, attract the acid in the air, and effervesce with it; whence the double advantage of a moiſt and looſe ſoil.

If

 Loam

If we attend to the infinite number of animals and vegetables which are rendered volatile by putrefaction, and fly off into the air; and to the quantity of perſpirable matter from animals and vegetables ſent into the air; and alſo to the effects of the acid found every where in the air on ſuch ſubſtances mixed with the earth; we need no longer wonder at the efficacy which writers, in all ages, have aſcribed to the air, with regard to it's quality of enriching the earth.

That the peculiar richneſs of ſoils is owing to the putrid or rotten particles mixed with them, is an opinion of long ſtanding. This is Virgil's *putre ſolum* [p], *rotten, crumbling*, or *looſe* earth; and that which Columella diſtinguiſhes [q] by the appellation of *pinguis et putris, fat and rotten*, or *fat, looſe*, and *crumbling*, as the ſoil which yields the greateſt profit with the leaſt labour and expence, becauſe it is naturally neareſt that ſtate which cultivation is intended to effect; "for, to cultivate, is no other "thing but to *open, looſen*, and *ferment* the earth."

From theſe principles it is that we account for the appearances before mentioned of good ſoils, ſuch as, their blackiſh or dark colour (which is that of all ſoils in a putrid ſtate,) their ready crumbling, eaſy mouldering, fragrance of ſmell, &c.

Mr. Evelyn conſtantly imputes the fruitfulneſs of the earth to a *nitrous ſalt*: but if theſe rich *putrid* ſubſtances are ſubſtituted inſtead of that *ſalt* (and it ſeems highly probable that he means them), we ſhall find that his reaſoning will appear full as ſtrong, more intelligible, and indeed more rational. The ſubſtance of p. 312. and 313, of his Philoſophical diſcourſe of earth, ſo far as relates to this matter, will then run thus.

[p] Georg. *Lib.* II. *v.* 204. [q] *Lib.* II. *c.* 2.

"It

"It is this *putrid* quality which entices roots to "affect the ſurface of the earth, upon which the "fertilizing rains and dews deſcend; which "makes all covered and long ſhaded earth, abound "in fertility; which reſuſcitates the dead and "mortified earth, when languiſhing and ſpent by "our indulgence to her verdant offſpring; her "vigour being quite exhauſted, till the rains and "ſhowers gently melt into her boſom what we "adminiſter to ſupply that which has been conſum-"ed. It is *this* which fertiliſes and renders Egypt "ſo luxuriantly fruitful after the inundations of "the Nile, &c."

When treating of the improvement of *Clay* and *Sand*, ſeveral manures were paſſed over with a ſlight mention, as being uſually employed on ſoils in which neither of the extremes, of tenacity in the one, or looſeneſs in the other, take place; and in this ſenſe, of their being fit for general uſe, they were called *general manures*; being adapted to preſerve all ſoils in a fertile ſtate.

I ſhall range theſe general manures under the following heads:

1. All foſſile ſubſtances, in their natural ſtate, and as altered by fire, ſuch as lime, chalk, marle, earth, ſand and ſhells; to which may be added the fixed alkaline ſalt of plants, which acts nearly in the ſame manner.

2. All the various manures obtained from vegetables, either in their natural or putrid ſtate: ſuch are ſucculent plants plowed in, tanner's bark, all the parts of vegetables which gradually decay, their putrid ſubſtance, ſoot, &c. *p. 85*

3. Animal manures; ſuch as blood, fleſh, dung, urine, wool, rags, hoofs, horns, bones, &c. *p. 98*

4. The proper mixture of theſe various ſubſtances, in compoſts, ſuited to the difference of ſoils. *p. 110*

ARTI-

ARTICLE I.

Of foſſile Subſtances uſed as manures.

THOUGH ſhells may more properly be reckoned an animal, than a foſſile body, yet, as they burn to lime, and in all other reſpects act as a calcarious ſubſtance, they are generally ranked in this claſs. Their uſe and application, together with that of ſand, has already been treated of ſufficiently. A very particular account has alſo been given of marle, in the improvement of ſand.—Calcined earths might be included under this article: but as *burn-baking* will be treated ſeparately, they will fall more properly under that head, to which, and to the article of *paſture-lands*, for the uſe of burnt clay, the reader is referred, in order to avoid repetitions.

I ſhall now ſpeak of lime-ſtone, and chalk, when burnt into lime.

The kiln commonly uſed for this purpoſe is a large pit, generally round, and of a ſize proportioned to the quantities intended to be burnt. It is wideſt at the top, and narrower, by degrees, as it comes nearer the bottom. The inſide of this pit is ſometimes lined with a wall built of lime-ſtone; but more commonly, and more properly with bricks: at the outſide, near the bottom, is a hole, or door, by which the aſhes are taken out; and above that, ſome have an iron grate, which comes cloſe to the wall round about: but others make an arch with ſtone, or large pieces of chalk; and upon this they lay a layer of ſtone, or of whatever elſe they burn in the kiln; upon this they place a layer of fuel, and ſo on, layer over layer, till the kiln is full; only obſerving that the outermoſt layer be always of the fuel, and not of chalk or ſtone. When the kiln is thus filled, fire is given at the hole underneath; and

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the lime is finiſhed in a different time, according to the nature of the ſubſtance. That made of chalk is generally burnt in twenty-four hours; but ſtone often requires ſixty hours. Ten buſhels of ſea-coal, or one hundred of faggots three feet long, will burn forty buſhels of chalk, which will yield thirty buſhels of unſlaked lime. Where chalk is ſcarce, the chalk rubbiſh is often worked up into a kind of paſte, with water, and made into a ſort of bricks, which are dried in the air, and then burnt into lime in the common way: but this is not quite ſo good as that which is burnt from the chalk ſtone [a].

The experience of late years has ſhewn that it is more profitable to burn lime in kilns ſhaped like a hogſhead; that is, ſmall in circumference at the bottom, gradually wider towards the middle, and then contracting again upwards to the top. This kiln, as Mr. Lummis obſerves in his letter to the Edinburgh ſociety, publiſhed by Mr. Maxwell [b], ſhould be made entirely within the ſurface of the ground, on the declivity of a little hill, where that ſituation can be had, ſo as to allow free acceſs to the air-hole or furnace. At the bottom, about a foot from the ground, are iron bars, placed horizontally a-croſs, to give the kiln a good draught, and upon theſe bars are laid, firſt ſmall wood or furze, then ſmall coals, then ſtones about the bigneſs of an egg, then another layer of fuel, and ſo on, increaſing the ſize of the ſtones towards the middle of the kiln, where they may be as big as half a peck, and decreaſing their ſize gradually up to the top, obſerving to lay the ſmalleſt neareſt to the ſides. The ſtones need not be broken ſo ſmall for this kiln, as for thoſe above ground; they will be burnt more truly without raw ſtones, or running

[a] MORTIMER, *vol.* I. *p.* 84. [b] *Practical Huſbandman, p.* 191.

into

into cinders; and not above half the quantity of fuel conſumed in the common way, will be uſed in this.

The following method of conſtructing another kiln, is thus particularly deſcribed in Mr. Maxwell's collection[c].

At bottom, the kiln muſt be three feet four inches wide; and at the height of two feet four inches, three feet ſix inches. At the depth of four feet and a half, it muſt be four feet and a half wide. A ſecond ſlope is then made five feet and a half higher, at the end of which, the kiln, then ten feet deep, ſhould be exactly ten feet wide within the walls. A third ſlope ſhould heighten it to fourteen feet, where it ſhould be exactly twelve feet and a half wide, likewiſe within the walls. From thence it is run up to the height of nineteen feet, when it ſhould be rather leſs than fifteen feet wide. The ſlopes muſt be made as gradual as poſſible, and the inner ſurface of the kiln muſt be quite ſmooth, that it's contents may fall down equally when the burnt ſtones are drawn out below. By extending a line from a pole fixed in the center of the bottom or floor of the kiln, to the ſides, workmen will eaſily be guided in making the abovementioned ſlopes. This kiln has four vents, oppoſite to one another, and no croſs-irons whereupon to lay the coals and ſtones, they being ſupported by old timber, furze, broom, &c. above which the coals are laid: but if the kiln be built on the ſide of a hill, it can have but three vents. The firſt layer of ſtones above the vents ſhould be cloſely jambed in, and reſt againſt the ſides of the wall. A kiln of the above dimenſions will burn eighty buſhels of lime-ſtones in a day: but it may be made larger, without altering theſe di-

[c] *page.* 198.

menſions,

menſions, by only adding two or three feet to the height, which will require ſtrong walls. This addition to the height need not be ſloped, but may be made perpendicular.

The late earl of Stair had a kiln at New Liſton, and others in Galloway, built in the ſhape of an egg, opened a little at both ends, and ſet upon the ſmalleſt. This kiln anſwered exceedingly well, and beſides lime-ſtone, burnt any kind of earth that was thrown into it.

Kilns thus built, ſwelling at or about the middle, and contracting again at the top, reverberate more ſtrongly, and make a more intenſe heat, than thoſe which grow wider and wider, and are not contracted.

When the kiln is filled, or finiſhed as 'tis commonly termed, it ſhould be covered over with ſods or ſtrong turf, to keep the heat as intenſe as poſſible, and hinder the wind from blowing the fire at the top, or rain from abating or extinguiſhing it. The ſtones muſt be broken in pieces before they are thrown into the kiln; otherwiſe the air contained in their cavities, being expanded by the heat, will often make them fly with ſuch violence as to damage the kiln. For this reaſon they ſhould be broken ſmaller for kilns that are above ground, than for thoſe which are underneath. The ſaving of this labour, and of near half the quantity of fuel, renders theſe laſt greatly preferable.

Lime is made of chalk, or of any ſtone that is not too cold, or ſandy, as free ſtone and the like. All the ſoft ſtones that are of a tolerably cloſe texture, will burn to good lime, as will alſo marble, ſlate, ſea-ſhells, corals, and flints; but this laſt kind of ſtone is more difficult to be burnt into lime than the others, except in a reverberatory kiln, becauſe it is apt to run to glaſs. The hardeſt, firmeſt, and whiteſt ſtones make the beſt lime; and when

when it is made of chalk, that which is formed of the hard ſtony kind, is much better than that which is made from the ſoft; but the harder the ſtones are, the more fire is required to burn them. Both ſorts may be burnt with wood, coals, turf, furze, or fern, which make a very fierce fire.

Theſe kilns ſeem to be intended for burning only one kiln full at a time: but where there is a great demand for lime, perpetual kilns, that is, kilns where the fire is kept conſtantly burning, are conſtructed on nearly the ſame principles. Here the iron bars at the bottom are abſolutely neceſſary, in order to take out the lime, as it is burnt. When ſtone-lime, which requires the moſt violent fire, is burnt in theſe kilns, vents are made near the bottom, to be opened occaſionally, according as the wind ſits, that a ſtronger current of air may quicken the fire, and thereby give it the more power. I am informed by an ingenious Gentleman lately returned from China, where they burn very hard lime-ſtone, that they there uſe a fan, ſimilar to that with which we winnow corn, to throw a ſtrong blaſt of air through a narrow channel, to the bottom of the kiln, which creates ſo fierce a fire as to calcine the hardeſt marble. A bare view of this fan, which will be more particularly deſcribed hereafter, and of the channel leading to the kiln (*Fig.* 1. *Pl.* II.) will give a ſufficiently clear idea of its uſe on this occaſion.

The moſt certain way to know whether any ſort of ſtone be fit for making lime, is, to drop upon it a little *aqua-fortis*, or ſpirit of ſea-ſalt. All ſtones on which the above, or any other ſtrong acid, effervesces, or riſes in bubbles, are lime-ſtones, or will burn to lime; and the ſtronger the effervescence is, the fitter they are for it. All country-gentlemen ſhould have ſome ſuch ſpirit by them, to try the nature of the ſtones that may be found on, or in, their lands.

All

Lime

All lime is a very good manure, but that made of ſtone is much better than what is made of chalk. It makes the greateſt improvement upon light ſandy ſoils, or upon a dry gravel: wet and cold gravel is leſs benefited by it, and cold clay the leaſt of all. The common allowance is a buſhel to a pole ſquare, or a hundred and ſixty buſhels to an acre. Mr. Lummis laid after the rate of three hundred buſhels on an acre, and found it anſwer extremely well: — but that was upon a ſtrong clay. His method of uſing it, as communicated to the Edinburgh ſociety [d], and the reſult, he ſays, of what he has experimented to be beſt, is as follows.

In the month of October, he lays together three or four of the largeſt ſtones (burnt into lime) on the ſward or turf of a ſtrong clay ground; or as many of the ſmall ſtones as are equal to the large ones, ſo that ſeventy or eighty bolls (two hundred and eighty or three hundred and twenty buſhels) may complete an acre. If rain falls, it melts immediately; if not, it will melt or ſlake in forty eight hours, or leſs, according to the moiſture of the air. He then ſpreads it directly, leaving no part of it upon the ſpot where the ſtones were laid. This done, he lets it lie twelve months, or till the month of November after the October twelve months, when he plows it in, and lets it remain in that ſtate all the winter, during which froſt and rains mellow and prepare the ground for the next ſpring plowing, and render it fit for barley. He prefers this method to laying the lime on in powder; becauſe, in this laſt way, it is apt to be blown about with the wind, to the great detriment of both men and horſes; ſuch as ſpoiling the mens eyes, hair, and cloaths, and the eyes and hair of

[d] MAXWELL's *Practical Huſbandman*, *p.* 191.

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the horſes, making their coats look dry and ugly; beſides loſing much of the lime.

The lime laid in the month of October, as above directed, on a ſtrong arable land, which has been ſome years under graſs, and continuing ſpread for about twelve months before it be plowed in, has been found ſo to alter the graſs to a fine natural clover, that, by feeding of ſheep or black cattle upon it, it has paid the whole charge the firſt year by the graſs; and cattle will chooſe rather to feed on this ground than any other, and grow fatter.—If the ground be looſe and open, it may be plowed in the enſuing March, if limed in October.—In either way, it ſo far meliorates the ſward, and the ſoil, that the beſt of crops may be expected for three or four years; and by laying ſome dung upon it the fourth or fifth year, two or three crops more may be obtained; after which the ground will be in excellent order to lay down with graſs ſeeds.

Notwithſtanding that lime is ſo very good a manure, Mr. Lummis prefers marle, if it can be had within the ground, or near the place where it is to be uſed: for though it be more chargeable at firſt, yet, laſting five times as long, it is in the end much cheaper. He generally lays near two hundred loads of it upon an acre, at about ſeven or eight buſhels to the load.

Mr. Evelyn[e] adviſes mixing the lime with the turf or ſward, laying them alternately, turf on lime, and lime on turf, in heaps, for ſix months; by which means it will become ſo rich and mellow, as to diſſolve and run like aſhes, and carry a much more cheriſhing vigour, than if uſed alone in a greater quantity, and without danger of burning out and exhauſting the vegetative virtue which

[e] p. 306.

Lime

it ſhould preſerve.— It is likewiſe greatly bettered by being mixed with dung, or with mud drawn from the bottom of ponds or rivers. In Weſtmoreland, they reap fine crops of barley from their ſandy lands, by manuring them with lime and cow-dung mixed together.

The nature of lime on land is like that of chalk: it works downwards, as the farmers expreſs it, and is therefore beſt treated in the ſame manner, laying it upon a lay the year before it is to be plowed up. When uſed on land which lies upon a deſcent, it ſhould by all means be mixed with dung, and laid principally on the higher part of the land; the conſequence of which will be, that the rain will waſh out the virtues of the lime and dung together, and carry them to the lower parts as it runs down. In fact, it does better on any land, when mixed with dung, than either of them alone. This is particularly obſerved in Shropſhire, where they lay dung and lime together, about twenty load of the former, and only twenty buſhels of the latter, on an acre of ground. — In Leiceſterſhire, they ſow or ſcatter the lime on wheat-land when they ſow the wheat; but on barley-land, the laſt earth but one, leſt it ſhould burn the barley if ſowed with it in the ſpring. They allow five quarters to an acre of each, reckoning by the meaſure in which it comes from the kiln; for after it is ſlaked, thoſe five quarters will make near ten.

Lime is thought to make corn grow with a thin huſk. It is a great deſtroyer of moſs and ruſhes, even after it has been ſlaked; as quick-lime is of the remnants of furzes, after the old buſhes have been grubbed up. It's hot quality renders it apt to over-burn dry ſoils. — It certainly is moſt efficacious when ſpread directly from the kiln.

Mr.

Mr. Liſle, whoſe account of lime[f] is almoſt unintelligibly perplexed and confuſed, thinks it is beſt, eſpecially on lands that work mellow, to ſpread and plow in this manure as ſoon as it is ſlaked, rather than to let it lie long in heaps covered with earth. He very properly gives it as a rule to all huſbandmen, to be cautious of liming ground, and then plowing out the heart of it; the bad conſequence of which, he himſelf experienced. "I "limed, ſays he, ſome years ago, in Wiltſhire "ſeven acres for an experiment, and laid down "one acre to it's own natural graſs. In two years "time this graſs was, and ſtill is, worth forty "ſhillings an acre. The third year, I laid down "another acre, which is ſtill worth thirty ſhillings "a year. The reſt, which I plowed five or ſix "years longer, is not worth fifteen groats an acre. "— I have experienced the like in burn-baking "ground."

The practice of Lower Normandy, where lime is chiefly uſed on lands newly broken up, is thus related by M. Du Hamel[g].

After giving theſe lands a ſhallow plowing, they carry on the lime, as it comes from the kiln, and lay about an hundred weight of it in a heap on every ſquare perch; ſo that the heaps lie at a perch diſtance from one another: they then raiſe the earth all round the heaps, like ſo many baſons: the earth which forms the ſides of theſe baſons, ſhould be a foot thick: and laſtly, they arch the heaps over with earth, ſix inches thick. The lime ſlakes under this covering, and is reduced to powder: but at the ſame time it increaſes in bulk, and thereby cracks the earth. If theſe cracks be not carefully ſtopped, rain will get through them,

[f] *Obſervations in Huſbandry, Vol.* I. *p.* 69, *&c.*
[g] *Culture des Terres, Tom.* III. *c.* 1. § 6.

and reduce the lime into a paſte, or kind of mortar, which will not mix with the earth, or anſwer the end propoſed. Farmers are therefore very careful to examine the heaps from time to time, and ſtop the cracks. Some only preſs down the top of the heap with the back of a ſhovel: but this method is liable to a conſiderable inconvenience; for if the lime be in a paſte within the heap, it is by this means beat together in ſuch manner that it becomes ſtill more difficult to mix it with the earth: for which reaſon it is better to ſtop the crevices by throwing a little freſh earth over the heap.

When the lime is throughly ſlaked and reduced to powder, the heaps are cut with a ſhovel, and the lime is mixed as well as poſſible with the earth that covered it. This mixture is then thrown up in heaps again, and left expoſed to the air for ſix weeks or two months: for then the rain will not hurt it.

About the beginning of June, this compoſt of lime and earth is ſpread upon the land; but not by throwing it about unequally, or at random: on the contrary, it is taken up by ſhovel-fulls, and diſtributed in little heaps, at equal diſtances, on each perch of ground; it having been obſerved, that theſe little heaps promote vegetation, more than if the manure was ſpread uniformly all over the field; nor is it at all heeded if ſmall intervals remain unlimed between each ſhovel-full. The field is afterwards plowed, for the laſt time, very deep: then, towards the end of June, it is ſowed with buck-wheat, which is covered with a harrow; and if any clods remain, they are broken with a hoe.

Buck-wheat occupies the land about a hundred days; ſo that this grain, ſown about the end of June, is gathered about the end of September.

When

When the ſtalks and roots of this plant are dead and dried, the ground is plowed up, and immediately ſowed with wheat, which is harrowed in. After the wheat has been reaped, the land is plowed as ſoon as poſſible. It is plowed for the laſt time, in February or March, in order to ſow oats; or in April for barley: but in this caſe it is turned up two or three times, to make it fine. All theſe different grains are harrowed in. A roller is paſſed over the oats when they are come up; and if any clods remain in the barley, they are broken with a hoe.

In the next February or March, the land is plowed again, in order to ſow it with gray peas or vetches: and after theſe pulſe have been reaped, one or two plowings are given, to prepare it for wheat in the enſuing autumn.

The next year, oats are ſowed, ſometimes mixed with a little clover; and then the ground is laid down to paſture for three or four years.

Sometimes no buck-wheat is ſowed on land newly broken up; but it lies fallow, from the month of March, when it was firſt plowed, till October, when it is ſowed with wheat, after receiving ſeveral plowings during the intermediate time. Theſe lands being, by this means, brought to a tolerable tilth, not above three quarters of the quantity of lime abovementioned is uſed on them, and they generally bear a better crop than thoſe which are firſt ſowed with buck-wheat.

Some farmers think a perch too great a diſtance for conveniently ſpreading the lime. They therefore make the heaps leſs, and increaſe their number in proportion. Others lay the lime in ridges, from one end of the field to the other; which facilitates the ſpreading of it. — Being perſuaded that lime is moſt efficacious when it lies ſhallow in the ground, they firſt plow it in, and then

Lime

give a ſecond plowing before they ſow, which brings it again near the ſurface.

Obj.

Lime is commonly ſaid to enrich land greatly at firſt, but afterwards, when it's efficacy is exhauſted, to leave the ground more barren than it was before. — Lime readily unites with every unctuous ſubſtance, and renders it more ſoluble in water. By this means, all ſuch particles mixt with the ſoil may be more ſpeedily converted to the nouriſhment of vegetables, than they might otherwiſe be. Indeed, if the farmer's avarice, or want of judgment, tempt him to over-crop the ground, it may be left without matter fit to nouriſh plants, till a freſh ſupply is brought: but if it be judiciouſly cropped, and left in good heart under graſs, or any other produce which does not impoveriſh the ſoil, the effect of the lime will be more durable, and more advantageous than is generally imagined.

Chalk is a laſting manure for ſuch lands as it agrees with, which are particularly thoſe of a cold ſour nature, proper for it's calcarious qualities to work upon. Pliny tells us [h] it was the cuſtom of the Britons to chalk their lands, by which they received a great and laſting improvement.

Farmers are apt not to diſtinguiſh ſufficiently between the different kinds of chalk. The hard, dry, and firm, is much the fitteſt for burning into lime; but the ſoft unctuous chalk is by far the beſt to be uſed crude. This oily viſcous ſort of chalk is uſed in many places inſtead of marle, to which it is nearly allied, though of an inferior quality. It is even called marle in the iſle of Wight, where their chalk is of a remarkably fat ſoapy nature, and they ſometimes lay twenty five waggon loads of it upon an acre of ground. [i] — It is a fine corrector of all acidities in the earth;

[h] *Lib.* XVII. *c.* 8. [i] LISLE's *Huſbandry, Vol.* I. *p.* 66.

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but found to be moſt efficacious neareſt to the time of it's being laid on. It changes the very nature of the ſoil, and makes it extremely rich while it's effects laſt: but it ſoon exhauſts itſelf, and requires dunging to keep it in heart afterwards. A ſecond chalking will prove of very little benefit to thoſe lands which ſucceded ever ſo well with the firſt, unleſs they have lain a long time to recover themſelves after it. Hence that trite ſaying of farmers, that chalk makes a rich tenant, but a poor landlord.

The beſt method therefore of uſing chalk, in which both Mr. Worlidge[k] and Mr. Mortimer[l] agree, is to mix it with earth, mud, or dung; about one load of the former to two or three loads of the latter. This will make it not only a temporary, but a laſting advantage to the ground; and the improvement will be ſtill greater if this compoſt be laid by for two or three years, and frequently well ſtirred and mixed during that time, before it be laid on. — It is obſerved to do moſt good to thoſe lands which lie fartheſt from any natural beds of it; the ground near chalk beds partaking of their nature, though no chalk maybe diſtinguiſhable in it by the eye. — The common method of chalking lands, is to lay twelve or fourteen loads of chalk upon every acre; and this will ſometimes make them bring very rich crops for fourteen or fifteen years together. — It is beſt to carry the chalk on upon a lay a year or two before it is plowed in: by this means it will ſweeten the ſurface of the earth, and will not work ſo much downwards, as it will if plowed in at firſt. — It makes corn yield well; and when laid upon graſs-ground (in which light it will be more fully treated of in the article of paſture

[k] *p.* 65. [l] *Vol.* I. *p.* 83.

lands), it makes the graſs ſweet and rich, and cattle that feed there fatten ſoon. The cows alſo that feed in theſe paſtures, are obſerved to give better milk than ordinary.

They have an excellent way of digging chalk in Kent, where it lies on the ſides of hills. The workmen undermine it as far as they think proper, and then dig a trench at the top, as far diſtant from the edge as the undermining goes at the bottom. This trench is filled with water, which ſoaks through in the ſpace of one night, and the whole flake falls down at once.

In other parts of the kingdom, chalk generally lies deeper, and muſt often be dug for to conſiderable depths, from whence it is drawn up in buckets: yet in theſe places, it ſells cheap enough at the mouth of the pit to be worth buying, even to carry a great way, for manure. — The farmers in the hundreds of Eſſex bring their chalk as far as from Graveſend, but lay not half ſo much upon their land, as thoſe of the iſle of Wight.

Chalk, ſays Mr. Liſle[m], is not an improver to land in the ſame way as dung, which gives virtue to the ſoil, and impregnates it with a fat, ſalt, nitrous quality, communicating to it the very principles of vegetation; but rather as a great ſweetener of ſour land, and a powerful opener of the pores and particles of the earth, which is thereby aſſiſted to exert all it's ſtrength. It is not, like dung, rich in its own nature, but only mellows the land, ſo as to looſen it's parts; by which means every particle of it is enabled to communicate it's vegetative virtue. For this reaſon, land abuſed by over-plowing after chalking, or plowed as long as it will carry corn, muſt be laid down to graſs in a poorer condition than a field that has been only

[m] *Vol.* I. *p.* 65.

dunged:

dunged: for it is almoſt impoſſible entirely to exhauſt the goodneſs of this laſt; as all it's particles cannot be looſened, nor every clod of it be unlocked, ſo as to let out all it's virtue, without the help of chalk; which, therefore, is rather a midwife to deliver the earth of her fruitfulneſs, than the immediate conveyer of fertility. — As chalk fills up the vacuities of ſandy ground [n], ſo, on the contrary, it inſinuates it's particles into obſtinate clayey and ſtrong land, and divides it, by making in a manner a ſciſſure; thereby hollowing and mellowing it: ſo that the two contrary extremes are cured by chalk.

Chalk ſhould not be dug in ſummer, to be laid on in winter, as is ſometimes practiſed; becauſe, when hardened by the ſun and air, it will not eaſily diſſolve afterwards, but will be apt to remain in lumps. The beſt time for digging it is from November to February. It cannot, indeed, be ſo well carried in winter; the days being ſhorter, and the chalk more fat and clammy then than at any other time, and conſequently more difficult to load. — It certainly ought never to be plowed in, either too ſoon, or too deep; but ſhould have time to crack and moulder on the ſurface of the earth, and not be turned down to the bottom of the furrow, leſt it ſhould ſubſide there in a maſs, and not be ſtirred by ſubſequent plowings: but the ſooner it is ſpread, the more it's effects will be perceived.

Mr. Bradley thinks [o] that if this ſoft chalk, fit for manure in it's crude ſtate, be dug and let lie for a year or two in heaps or pits, where water may come frequently to it, or remain conſtantly upon it, it will be much bettered, and do more ſervice to the land, than if it was to be laid on as ſoon as

[n] *p.* 67. [o] *p.* 64.

Chalk. thug. — "Some farmers," continues he, "are ſo "fond of chalk, that they hardly think their "ground will produce any thing without it; nay, "I know ſome landlords who will pay their te- "nants for the chalk they lay upon their lands, "by giving them ſome years rent of their farms, "on condition they lay a certain number of loads "of chalk upon every acre. This I have obſerved "has been, and ſtill is practiſed with ſo little "judgement, in ſome places, that I cannot help "pitying the perſons who are engaged in it; for "I find all chalks are alike to them, and all ſoils "too. Let them be of what ſort ſoever, ſtill they "muſt be chalked, notwithſtanding there are far "better manures in the very farms which are "thus diſpoſed, and perhaps every load of chalk "is brought ſeven or eight miles."

Mr. Worlidge, in his art of Gardening [p], ſays, that chalky land may be dealt with in the ſame manner as clay land, though in a moderate way: for chalky land is naturally cold, and therefore requires warm applications: it is alſo ſad, and will the better bear light compoſts: which is the reaſon why chalk is a great improver of light, hot, and dry grounds,

Stones It has been argued, and is not yet determined, whether ſtones are hurtful, or beneficial, to arable lands. Examples are not wanting on both ſides of the queſtion; though, in general, it ſeems rather to be carried for them. However, nothing can excuſe leaving a ſtone in any ground ſo large as to interrupt the plough. If they are very large, they ſhould be blown to pieces with gun-powder, and then be carried off. Some ſpots, very fertile in ſeveral kinds of grain, ſeem to conſiſt of nothing but ſtones; and inſtances are given of fields being

[p] p. 13.

rendered

rendered barren by taking away the ſtones which covered them. Theophraſtus[r] accounts for this in a hot country, where it happened to the Corinthians, by ſaying, that the ſtones ſhelter the earth from the ſcorching heat of the ſun, and thereby preſerve it's moiſture. The ſame holds true even in our colder latitude, where the heat of the ſun is leſs apt to hurt us; and Mr. Evelyn is clearly of opinion[s] that huſbandmen rather impoveriſh, than improve, thoſe grounds which are almoſt covered with ſtones, eſpecially where corn is ſown, if they pick them off too minutely; becauſe they thereby expoſe the land too much to the effects of heat and cold. — Certain it is, that a moderate mixture of ſmall gravel preſerves the earth both warm and looſe, and prevents too ſudden exhalations. But it ſeems highly probable that there muſt be ſome farther reaſon, beyond what has yet been aſſigned, for the benefit ariſing from ſtones. The example already given[t] of the ſtone uſed in Oxfordſhire; and a remarkable incident which happened to M. Du Hamel, give great room to think that the ſtones which are thus beneficial, are of the lime-ſtone or calcarious kind.

"The ſtone which is uſed for building at "Denainvilliers", ſays M. Du Hamel[u] "is very "hard. It bears poliſhing like marble; and is here "and there intermixed with ſhells, ſome of which "are filled with a kind of oaker, and others con-"tain a cryſtaline ſubſtance. This ſtone is very fit "to make lime of. Some workmen, who were "building about our houſe, cut pieces of this "ſtone upon a graſs-plat. When they had done "their work, the rubbiſh was cleared away, and "nothing was left upon the graſs but the duſt

[r] *In* CONRADO HERESBACHIO, *de Re ruſtica, Lib.* I. *p.* 78.
[s] *p.* 305. [t] *p.* 30. [u] *Tom.* V. *p.* 220.

and

"and very ſmall fragments, which had fallen from "the ſtones in cutting them. The next year, the "graſs grew ſupriſingly thick in all the places "where theſe ſtones had been cut, was much taller "and greener than any where elſe, and preſerved "it's vigour for ſeveral years. One would ſcarcely "have thought that ſo hard a ſtone, reduced to "powder would have produced an effect like that "of marle. The goodneſs of lime, as a manure, "is, perhaps, chiefly owing to the fineneſs of the "powder, to which the lime-ſtones are reduced by "calcination."

"This fact may help to clear up another, which "cannot have eſcaped the notice of thoſe who "attend to the differences of ſoils. They muſt "have obſerved ſome grounds ſo thickly covered "with ſtones, that ſcarce any thing elſe is ſeen "after a heavy ſhower of rain. Yet ſome of theſe "lands are very fertile, and produce fine wheat. "I know not whether I am miſtaken; but I think "I have obſerved that this fertility is found only "in fields where thoſe ſtones are calcarious. It "is very probable that the duſt which is form-"ed by the mutual rubbing of theſe ſtones con-"tributes to that fertility."

The farmer may eaſily inform himſelf whether this be the caſe; and if it is, he has a certain rule to go by in the management of ſtones; *viz.* by trying with *aqua fortis*, or ſpirit of ſea-ſalt, as mentioned before, whether they are calcarious or not: for every ſtone on which the ſpirit does not effervesce, is of no uſe, and therefore ſhould be removed, as an impediment to the neceſſary labour. However, the prudent husbandman will make the experiment of clearing his land, firſt on a ſmall ſpot; that he may be ſure of the ſucceſs, before he embarks in a greater expence.

Peat Ashes.

Aſhes made from foſſile ſubſtances belong properly to this article. Turf and peat aſhes muſt needs be very rich as Mr. Worlidge rightly obſerves[u]; they acting much in the ſame manner as the burning of land, and generally containing a ſmall portion of alkaline ſalt. Mr. Miller thinks they are greatly bettered by being mixed with lime before they are laid on. Mr. Ellis's diſtinction between the ſtrength of the aſhes of lean-peat, and thoſe of the fatter kind, ſeems to be founded in reaſon, as well as on experience. "If barley, ſays, "he[w], be ſown ſo late as the beginning of May, "lean peat-aſhes in particular may be applied "over it, or harrowed in with the grain: but aſhes "burnt from fat black peat, ſuch as is dug at "Newbury, are of ſo ſulphureous a nature, that "farmers are afraid to lay them on their barley; nor "do they dreſs their wheat with them till the ſpring "is advanced, and then they are ſown over it."

"The earth of which this rich manure is made, "is taken from a black mooriſh ground, with a "narrow wooden ſcoop, which brings it out like a "long brick. Theſe pieces of ſwampy earth are "laid on the ground to dry in the ſummer; after "which they ſell for eight ſhillings a waggon-"load, for fuel. But when they are to be uſed "for manure, after being dried, they are burnt in "heaps of ten, twenty, or thirty loads, laying "on more peat upon the outſides, as the fire in-"creaſes within, to keep it from having too much "vent."

"The great uſe of theſe aſhes was diſcovered "about thirty (now more than fifty) years ago: "but they ſoon after fell into diſrepute; owing "to the injudicious management of people, who

[u] *p.* 72. [w] *Modern Huſbandman, Vol.* II. *May, p.* 68.

his

Peat ashes

"imprudently laid on too great quantities of them "at a time, by which means their corn was burnt. "Afterwards, they found that ſix, or at moſt ten, "buſhels were ſufficient to be ſown over an acre of "wheat, peas, turnips, clover, rape-ſeed, or ſain-"foin, as early as could conveniently be done. But "ſtill many are afraid to ſow them over barley, leſt a "dry ſeaſon ſhould enſue, and burn it up: for theſe "aſhes are thought to contain three times as "much ſulphur as there is in coal-aſhes. This is "reaſonably ſuppoſed from their very ſtrong ſul-"phureous ſmell; their ſparkling and jumping "when ſtirred while burning, and their drying up "corn by their too great heat. Theſe peat-aſhes, "and likewiſe thoſe of wood or coal, will help to "keep off the ſlug from peas and other grains, by "the ſalt and ſulphur contained in them; and "conduce very much to their preſervation in cold "wet ſeaſons. But no danger of over-heating need "be feared from the aſhes of that peat which "grows, as turf, over ſandy bottoms, as great "quantities do on Leighton-heath in Bedfordſhire; "for theſe are as much too lean, as the others "are too rank."

A gentleman in France having met with a foſſile of this kind, communicated his diſcovery to M. Du Hamel, who, judging that it may be of ſervice to others who may chance to meet with the ſame ſort of earth, has obliged the public with the following account of it [x].

"This foſſile is a blackiſh earth, like the ſoil of "ſome meadows. When burnt, it emits a thick, "diſagreeable ſulphureous vapour. A certain de-"gree of moiſture helps to make it burn; though "even then, it waſtes but ſlowly. After it has "once taken fire, it burns on of itſelf; but with-

x *Tom.* V. *p.* 226.

"out

" out producing any flame. It is of ſo cauſtic a na-
" ture, that it would flea the hands and feet of the
" men who knead it, if they did not take precau-
" tions to guard againſt that inconvenience. It's
" aſhes retain this cauſtic quality; for the hands of
" the peaſants who ſtrew them are often hurt by
" it, if the air be at all damp. This earth, in it's
" natural poſition, runs in veins of different ſizes;
" ſometimes ſeven or eight feet thick, and thirty
" or forty feet long; and ſometimes they extend
" four or five hundred feet; after which the vein
" often fails at once, and perhaps is not found again
" till two or three miles off. Theſe veins gene-
" rally lie pretty near the ſurface of the earth;
" ſeldom deeper than twelve or fifteen feet."

" This earth is found only in marſhy places,
" which muſt ſometimes be drained before it can
" be come at. It ſhews itſelf by a ſlimy ſkin over
" the waters around it."

" Three pounds of this earth, being diſtilled,
" produced about fifteen ounces of a bituminous
" oil, pretty much like that which is extracted
" from pit-coal; and the *caput mortuum* (or reſidue
" after diſtillation) yielded, when waſhed, about
" half a pound of copperas."

" The method of preparing this earth in order
" to render it fit for fertilizing land, is as follows.
" Water is thrown over it, and two or three men
" knead it with their feet till they bring it to the
" conſiſtence of a paſte, which is then made into
" cakes ſeven or eight inches in diameter. Theſe
" cakes are laid by to dry; though not to ſuch a
" degree but that there ſtill remains a little moi-
" ſture in them: that being neceſſary to facilitate
" their burning."

" The cakes thus prepared are piled up in the
" form of a pyramid, with ſufficient ſpaces be-
" tween them for the fire to penetrate; and under

" this

" this pyramid, which is made upon a kind of " hearth, a little ſtraw and bruſh wood is laid, to " ſet them on fire. Two or three days after, their " aſhes are ſpread with a rake, that they may " cool. Some veins of this earth yield white aſhes: " but they are not ſo good as thoſe of a reddiſh " hue."

" From fifty to ſeventy pounds of theſe aſhes are " ſpread upon each acre of land in April or May; " and in about a week's time the blades of corn, " or of graſs if it be paſture ground, aſſume a " new verdure, and appear ſurpriſingly ſtrong, even " in the coldeſt ſoils."

" Some of theſe foſſile earths are better than " others. Care muſt be taken to begin to rake " out the aſhes of each pyramid as ſoon as the " greateſt part of it is burnt; for they would loſe " a great deal of their virtue if left in the fire till " all that is inflammable be conſumed: nor would " the fire go out in leſs than a fort'night or three " weeks, if they were not ſcraped away as they " are formed."

" I need not ſay, that a greater quantity of the " aſhes of an inferior quality muſt be uſed, than " of thoſe which are ſtronger, and conſequently " better; but it may not be amiſs to obſerve, that, " in general, wet lands require more than dry " ſoils. The effects of this manure will be mani- " feſt for two or three years. It might be dan- " gerous to renew it every year."

" There ſeems to be ſome analogy between " this earth and foſſile coal. It ſmells diſagreeably " ſulphureous and bituminous when burnt, and it's " aſhes ſeem to contain iron. I believe the aſhes " of foſſile coal might likewiſe ſerve to fertilize " land."

This laſt thought agrees with Mr. Mortimer, who eſteems ſea-coal aſhes the beſt of any for cold

Peat ashes

cold lands [y], the moſt laſting, and the fitteſt to kill worms. Their ſharp and drying quality opens the pores of ſtiff ſoils, and diſcharges a great deal of their viſcous quality [z]. Mr. Worlidge thinks them an excellent compoſt when mixed with horſe-dung. [a]: to which he adds, that they are a great curer of moſs and ruſhes in moſt grounds.

Sea-ſalt

It has long been diſputed whether ſea-ſalt be a good manure. It is very attractive of moiſture, and may therefore be of conſiderable uſe on dry ſoils, where it will retain humidity a great while. Experiments ſhew, that, in it's native ſtate, it rather retards, than promotes vegetation. It is therefore probable that it's beſt effect is where it meets with any degree of putrefaction, which renders the marine acid volatile: for it eaſily flies off, as is probably the caſe in ſalt marſhes as they are called. Mr. Worlidge mentions [b] the following inſtance of it's uſefulneſs on dry ſoils.

A buſhel of ſalt was ſowed on a patch of ground near Clapham, which remained freſher, greener, and of a thicker ſward, than all the reſt of the field about it. This, though not a beneficial experiment, by reaſon of the price of ſalt, is, however, a plain demonſtration of the fertility that is in ſalt, when uſed moderately upon dry lands.

Sea-ſalt laid on a clayey ſoil, in which there always is a vitriolic acid, is found to be beneficial: for the vitriolic acid of the clay is attracted by the calcarious earth, which is the matrix of the ſea-ſalt, and expels the acid of the ſalt, which is more volatile than the other. By this means the vitriolic acid is neutralized, and the body of the clay is rendered leſs denſe.

[y] *Vol.* I. 119. [z] BRADLEY, *p.* 86. [a] *p.* 72.
[b] *p.* 83.

Ashes of Vegetables.

The aſhes of vegetables, acting in nearly the ſame manner as the aſhes above deſcribed, naturally offer themſelves to our conſideration in this place, though not of the foſſile kind. Their efficacy depends entirely on the quantity of fixed alkaline ſalt contained in them. For this reaſon, they ſhould be carefully preſerved from wet, which would carry off their ſalt, and likewiſe from the free acceſs of the air, which, in time, might neutralize it. Were farmers aware of their efficacy when laid on clover, or other graſs, in the winter, or on wheat at the ſame ſeaſon, they would be more careful of them. Timber and perennial plants yield this ſalt at all ſeaſons: annual plants moſt when in full ſap, or at leaſt before their ſeeds ripen. The ſtubble therefore of ripe corn affords but little of it; and it is probable that the benefit which land receives by burning ſtubble, ariſes chiefly from the effect of the fire on the ſoil itſelf, whoſe ſurface it in ſome degree calcines, or renders calcarious. — One load of dry well preſerved aſhes will go as far as two or three loads of thoſe that have been more careleſsly kept. Though rain, or any other common water diminiſhes their virtue; the wetting them moderately ſometimes with urine, or ſoap-ſuds, adds greatly to their ſtrength, as Mr. Mortimer ſays[y] he has often experienced. Two loads of theſe well-conditioned aſhes will manure an acre of ground better than ſix loads, which is the common allowance, of thoſe that have been expoſed to all the influences of the weather.

Soap-aſhes, after the ſoap-boilers have done with them, are highly commended by Sir Hugh Platt, both for corn and graſs, and eſpecially for cold ſour lands. He gives an inſtance of a ſtalk and ear

[y] *Vol.* I. *p.* 118.

of barley an ell and three inches long, which grew on barren land, enriched with ſoap-aſhes, and ſays he found the like ſucceſs in paſture-ground. It is beſt to lay them on in the beginning of winter, that the rain may the more eaſily diſſolve and waſh them in. They are particularly eſteemed in Lombardy [a]. One of the worſt ſorts of land which we have, naturally over-run with broom and furze, after being manured with ſoap, produced vaſt crops of wheat for ſix years running. Mr. Mortimer, who mentions this [a] as a fact which happened near Ware, could not learn what was the nature of the ſoil, or the quantity of aſhes laid on it. The common allowance is eight loads to an acre; a cart-load being a cube of three feet. Some ſay it kills all ſorts of weeds, eſpecially furze, broom, and fern.

Kiln-aſhes, made of ſtraw, furze, &c. are a good manure for almoſt any kind of ſoil. In the Weſt of England, farmers ſift them over their corn and graſs: but this muſt not be done in windy weather, becauſe they are ſo very light that they would eaſily be blown away. They ſucceed beſt when laid on juſt before rain or ſnow.

Pot-aſhes are alſo of great ſervice to moſt ſorts of land: but as they have been, in a great meaſure, deprived of their ſalt by the pot-aſh-men, it is neceſſary to lay them on much thicker than other aſhes. A buſhel and a half of drawn aſhes may be uſed for a buſhel of freſh aſhes; but they ſhould always be mixed with ſome other light ingredient, which may be uſed in quantity, if laid on very ſtiff land. If the land be not over ſtiff, they may be laid upon it with leſs mixture [b].

The aſhes of ſea-weeds are much uſed in the Weſtern Iſles of Scotland, and are undoubtedly a

WORLIDGE, *p.* 83. [a] *Vol.* I. *p.* 119. [b] BRADLEY, *p.* 92.

fine manure, though by no means equal to what the ore weed is when laid on freſh from the ſea, as will be more fully obſerved in the next article.

Soot, either of vegetables or of coal, is good both for corn and graſs, eſpecially on cold moiſt grounds, or lands apt to be over-run with moſs. Many have found their account in ſtrewing it early over their green wheat and barley: but Mr. Ellis ſays neither of them ought to be ſooted after the 25th of April, becauſe the wheat, and generally the barley, have then done gathering and branching, and are upon the ſpindle. He likewiſe thinks it proper to be ſown over young turnips, juſt after they have appeared. But care ſhould always be taken not to ſtrew it too think, leſt it's hot nature ſhould hurt the plants. Mr. Worlidge[c] ſeems to think wood-ſoot the beſt: but Mr. Mortimer[d] prefers that which is made from ſea-coal, of which about forty buſhels are commonly allowed to an acre; though ſome grounds will require more: to which he adds, that it produces a very fine ſweet graſs, and deſtroys worms and weeds; and that it ought not to be ſown upon wheat till Candlemas, becauſe the long cold rains and ſnows are apt to waſh it in too ſoon: nor is it ſafe to lay it on later, leſt a drought ſucceed and burn it up.

Charcoal duſt has been proved to be of great benefit to land, eſpecially to ſuch as is ſour and ſtiff[e]: but it is not to be had in large quantities. However, as it is uſeful, it ought not to be paſſed over un-noticed. The way of uſing it is the ſame as for ſoot or wood-aſhes.

[c] p. 83. [d] p. 120. [e] BRADLEY, p. 97.

ARTI-

ARTICLE II.

Of Vegetable Manures.

ALL vegetables afford great abundance of excellent manure, in the ſtate in which nature preſents them. The cuſtom of plowing in green ſucculent plants, is very antient. All the Roman writers commend it highly, and with much reaſon. Columulla[a] recommends particularly lupins, as a manure, which, if cut down and turned in while green, will have as good effect as the beſt and ſtrongeſt dunging whatever. They may be ſown upon poor land about the middle of September, and will enrich it greatly if plowed in before they attain their full growth. In gravelly ſoils, they ſhould be cut down after they have put forth their ſecond flower; and in ſtrong lands, after the third. In the former of theſe grounds they are turned in while young and tender, that they may quickly rot; and in the latter, they are let ſtand till they grow ſtronger, that they may bare up the more ſolid and ſtiff clods of earth, and keep them the longer ſuſpended; by which means the air has freer acceſs to the ſoil, and theſe clods, being heated and dried with the ſummer ſuns, are the more eaſily opened, and reſolved into duſt. Thus ſays this judicious author, juſtly remarkable for his ſuperior ſkill in huſbandry.—But Mr. Miller, who underſtands gardening better than he does agriculture, and who certainly has not had equal experience in this laſt, is of a contrary opinion[b].

The *Maiſon Ruſtique*, a work of very high repute, as is evident from the great number of

[a] *Lib.* II. *c.* 16. [b] *Gardener's Dictionary, Art.* LUPINUS.

Vegetables

editions it has gone through *, ſtrongly and rightly recommends[d] peas, beans, lupins, vetches, and other ſucculent plants, as excellent manures, eſpecially for ſandy ground. Theſe plants enrich the earth greatly if plowed in, either green, or when in bloom. In ſtrong land, they ſhould not be turned down till the pods begin to harden. —In Piédmont and other places where they fatten their land with this manure, lupins are ſown upon the fallow ground towards the end of June, immediately after the ſecond plowing, ſo that they are ſtill green when the third plowing is given and the corn is ſown. Experience ſhews the huſbandmen in thoſe countries, that this method of uſing theſe plants for manure makes them ample amends for the loſs of the pulſe or fodder they might otherwiſe reap from them: but thoſe who do not like to loſe any thing, plow in the huſks after they have taken out the grain.

Pulse

Dr. Liſter likewiſe recommends[e] for the improvement of ſandy, light ground, or any clay well ſanded, all plants of the pulſe or pea kind, and particularly, "upon experience, the wood vetch *, "which, beſides it's being perennial (at leaſt with "reſpect to it's roots), and it's thriving even in "woods and among buſhes in almoſt every coun-"try, has theſe farther qualifications, that it ſhoots "out a thouſand roots far and wide, and ſpreads "itſelf under ground like quick-graſs; whilſt it "is ſo rampant above ground, that it will climb

* Sixteen in it's ſmaller ſize, from which it was tranſlated by Mr. Markham under the title of *The Country Farmer* (beſides ſeveral pirated Editions); and ſeven in it's preſent larger bulk of two very thick volumes in *Quarto*. The ſeventh, printed in 1755, is that which the writer of this work refers to.

d *Tom.* I. *p.* 604. e *Philoſoph. Tranſ. No.* 225.

* *Vicia meliſſera, nemorenſis perennis, ſive Dumetorum*; Mr. Miller's 2d ſpecies, *Art.* VICIA.

Vegetables

"a fathom and a half upon meaſure, and pre-
"ſerve itſelf in ſpite of weeds or drought. It
"may be ſet, as well as ſown, in furrows. For
"the former of theſe purpoſes the roots may be
"dug up in September, which is alſo the time for
"gathering the ripe ſeed. The growth of the
"plants will be greatly advanced by ſetting their
"roots; for the older they are, the ſtronger, more
"numerous, and fuller of buds their ſhoots will
"be. I ſowed in the latter end of March the
"ſeeds which I had gathered in September, and
"had that year a very great increaſe, the bed be-
"ing thick covered over with graſs above two
"feet high: but it did not flower that year. I
"reckoned that one pea had put forth above
"thirty ſhoots in Auguſt of the firſt year. In the
"ſecond year, it flowered by the middle of June,
"and bore a wonderful crop, the roots being in-
"numerable. I have obſerved this pea very com-
"mon in all the mountains, as well as plains of
"England, where buſhes or hedges are. Both
"the pea and graſs are very ſweet, and very agree-
"able to cattle, as I have tried."

Buck-wheat

Buck-wheat and vetches are the two plants moſt commonly ſown in England, for manure. The beſt time for plowing them in, is when they are in bloom; being then in their moſt ſucculent ſtate. Some farmers turn down their ſecond crop of clover, to enrich the land for wheat in the autumn. This ſhould be done early enough to give the plants ſufficient time to putrefy thoroughly before the grain is ſowed: otherwiſe it might prove prejudicial, by bringing on a heat which would hurt the corn.

Millet

The Reverend and ingenious Mr. Eliot, of New England, prefers [n] millet to every other plant

[n] IV. *Eſſay upon Field Huſbandry*, p. 24.

for green-dreſſing of land, on account of the cheapneſs of the ſeed, and the largeneſs of the ſtalks and leaves, which muſt afford a good coat to turn in when plowed. ---- An old farmer, who had long been in the practice of green-dreſſing, aſſured this gentleman, that he had increaſed the ſtrength of his land to a great degree, in a few years, by the following method. After his oats were harveſted, he added a little ſeed to the ſcattered grains, and then plowed them in. Towards the end of September, he plowed in the green oats, and ſowed rye; and the next ſummer, when the rye was well grown and full of ſap, he plowed that in at the uſual ſowing ſeaſon, then ſowed wheat, and always had a large crop.

The weeds of ponds, lakes, or ditches, being dragged out before they ſeed, and laid in heaps to rot, will make excellent manure; as well as moſt other ſorts of weeds, and almoſt all kinds of rotted vegetables. But wherever any weeds are employed, they ſhould be cut down as ſoon as they begin to flower: for if they are ſuffered to ſtand until their ſeeds are ripe, the land will be filled with weeds, which can hardly be deſtroyed in two or three years; nay, ſome kinds of weeds, if they ſtand only till their ſeeds are formed, will perfect them after they are cut down, and be thereby equally prejudicial to the ground. The ſureſt way therefore is to cut them down juſt as they begin to flower; at which time all vegetables are in their greateſt vigour, being then ſtronger and fuller of ſap, than when their ſeeds are farther advanced, more replete with ſalts, and conſequently fitter to be good manure. In rotting theſe vegetables, it is proper to mix ſome earth, mud, or other ſuch like ſubſtances with them, to prevent their taking fire in their fermentation, as they are very apt to do when laid in large heaps without any

mixture

mixture to prevent it. The heaps ſhould likewiſe be covered with earth, mud, or dung, to detain the ſalts, many of the finer particles of which will otherwiſe fly off in fermenting. When theſe vegetables are thoroughly rotted, they will form a ſolid maſs, which will cut like butter, and be very full of an oil extremely fit to enrich the land.

Sea-weeds are ſo beneficial a manure, that farmers ought not to grudge the expence of carrying them a few miles. In Devonſhire, Cornwall, and other maritime parts of England, theſe weeds are laid in heaps till they are rotten, and then ſpread upon the land, about a load to three rods: but this laſts only one year, unleſs ſand, or a ſtiff earth, according to the quality of the ſoil intended to be improved, be laid or mixed with them; and then they become a laſting manure. In ſome places, theſe weeds are gathered in heaps, and burnt as ſoon as they are dry; after which about a buſhel of their aſhes is laid upon three rods of ground. But theſe, like all other aſhes, ſhould be mixed with ſand, or ſtiff earth, if you would have the land laſt good: otherwiſe, they are only an improvement for a year. Theſe aſhes are particularly good for graſs grounds over-run with moſs[g]. —— Looſe ſandy ſoils are likewiſe peculiarly benefited by this weed: but, being a ſub-marine plant, the wind and ſun ſoon exhale it's moiſture; ſo that the more ſpeedily it is taken from the ſhore, where ſtorms often throw it up in great quantities, the better it is. When ſpread on the ground, and afterwards covered over, it ſoon diſſolves into a ſalt oily ſlime, proper to fertilize and bind light ſoils. This is the moſt approved way of applying it: though ſome lay it naked and freſh from the ſea, upon their barley lands, towards the end of

[g] BRADLEY's *Compleat Body of Huſbandry*, *p.* 91.

March

March and beginning of April, and have a good crop of corn: but ſuch quantities of rank weeds are apt to ſhoot up afterwards, that no wholeſome plant is to be expected that year.

The value of the lands all along the coaſt of Scotland has been more than doubled by the uſe of this excellent manure. It is chiefly uſed there for barley; and the farmers watch every opportunity when it is thrown in by the ſea, and lay it on at all ſeaſons, in autumn, winter, and ſpring. But if they could chooſe their time, it would probably do beſt about the month of March; for being then plowed into the ground, and afterwards plowed up again to the ſeed, it would be incorporated and blended with the ſoil: whereas, if it be laid on in autumn, before the fallowing or firſt plowing, it is too much waſted before the ſpring; and if it be laid on to the ſeed-furrow, it is apt to burn the ground in a dry ſeaſon, though it will do very well in this method in a wet ſummer. It's effects are but juſt felt the ſecond year; though it is laid thicker upon ſtrong clay land, which receives no other manure for three crops, *viz.* barley, oats, peas and beans; a method which might, perhaps, be altered for the better by omitting the oats, and ſowing alternately barley, and peas and beans, and laying on the ſea-ware, as theſe weeds are commonly called, for every ſecond crop of peas and beans.

We ſee by this abridgement of Mr. Scott's account of the manner of uſing ſea-ware in Scotland (publiſhed by Mr. Maxwell in his miſcellaneous papers[h]), that much of this valuable manure muſt neceſſarily be loſt through want of proper management: for they have no reſervoirs to keep it in, when thrown aſhore at a ſeaſon in which

[h] *p.* 126.

they

they cannot uſe it, or where there is no ground in tilth, as is generally the caſe in winter, and during the buſy part of their hay and corn harveſt. — It ſhould be collected on theſe occaſions, and lodged in a place free from any running water; and, as it is equally beneficial to ſtrong or light lands, it might be there covered with ſand or clay, according to the nature of the ſoil for which it is intended. This will prevent it's being parched by the ſun, or it's diſſolving into a putrid maſs, which, if not ſecured in this manner, would either be waſhed away by rains, or fly off into the air: whereas, when thus covered, it would greatly enrich the clay or ſand, and render them good manures for their oppoſite ſoils. If it be thrown aſhore at a time when it can be plowed in directly, that is certainly the beſt manner of uſing it.

Mr. Scott obſerves[1], that there is a kind of land all along the coaſt, which is gravelly, and covered over ſo thick with ſea-ſtones, that, to look at it, one would not think corn could ſpring through them; and another ſort of land, which is a deadiſh ſand. To both theſe grounds ſea-ware is the only manure; for dung of all kinds has been often tried, but with no ſucceſs; and yet ſea-ware makes them bring excellent crops of barley. This kind of ground is ſeldom plowed more than twice, and the ſea-weed is generally laid on before the firſt plowing. Barley is ſowed during two years, and peas the third; a freſh manure of ſea weed being laid on each year that barley is ſown. — As little wheat is cultivated in the country where Mr. Scott lived, the farmers there might probably improve their practice of raiſing barley and peas, by ſowing them alternately, and laying the ſea-ware to the peas. — In the ſummer, it is carried to a diſ-

[1] p. 127.

ſtance

Vegitables

lance from the ſea, and laid upon ley-ground (arable-land under graſs), which, though in very ill heart, will bear a good crop of oats with only once plowing, or of barley, if plowed again in the ſpring.

Another kind of ſea-ware, of a much ſtronger nature than that which is thrown up by the waves, is cut from the rocks at low water, and will laſt three years. It coſts more labour, but brings greater recompence. Mr. Scott thinks the beſt time of laying this on the ground would be in autumn, before the land is plowed rough for a ſpring crop.

The farmers on the coaſt of Scotland (and I believe the ſame may be ſaid, in general, of thoſe in moſt of the maritime parts of England), prefer this manure to any other, eſpecially for their light grounds; and it has the advantage of being much more eaſily tranſported, becauſe one load of it will go as far as two of dung.

It does very well in kitchen-gardens, where Mr. Scott ſays he has ſeen pot-herbs and roots of an extraordinary ſize produced by it's help; to which he adds, that he has known fruit-trees, perfectly barren before, rendered extremely fruitful by laying this manure about their roots *.

Mr. Du Hamel likewiſe informs us †, that theſe ſea-weeds are uſed with great ſucceſs in the maritime provinces of France.

Another excellent manure, greatly and very properly recommended by all writers on huſbandry,

* Mr. Martin, in his deſcription of the Scotch iſlands, ſays, that the aſhes of ſea-weeds are uſed there to preſerve cheeſe, inſtead of ſalt; that they ſcower flaxen thread better, and make it whiter, than any other thing; and that they are the beſt manure the inhabitants of thoſe parts have for their lands.

† *Tom.* VI. *p.* 195.

and

and not unknown to moſt farmers, is, rotten tanner's bark. The bark of trees in general, and eſpecially that of oak, contains a very rich ſalt, extremely uſeful in vegetation. One load of oak bark, laid in a heap and rotted after the tanners have uſed it for dreſſing of leather, will do more ſervice to ſtiff cold land, and it's effects will laſt longer, than two loads of the richeſt dung. Mr. Miller is right in thinking it better for cold ſtrong land, than for light hot ground, if it be uſed alone, as taken from the tan-yard; becauſe it is of a warm nature, and will looſen and ſeparate the earth ſo effectually, that, by uſing it only three or four times, a ſtrong ſoil, not eaſy to be wrought, will be rendered perfectly light and looſe: but by mixing it with earth of a nature contrary to that which it is intended to correct, and in a proportion ſuited to the nature of the ſoil it is to be laid on, it will prove a fine manure for almoſt any land; it's ſalts being ſuch as will greatly fertilize the ground. It will even alter the very nature of the ſoil, and turn it into a rich black mould. It neceſſarily abounds in vegetable parts, derived from the tree to which it once belonged; and cannot but be ſtrongly impregnated with animal juices, as it lies a long time in the tan vatts, with the ſkins and hides of animals: circumſtances which muſt make it ſingularly beneficial to all poor lands.—If laid on graſs, it ſhould be ſpread ſoon after Michaelmas, that the winter rains may waſh it into the ground: for if it be laid on in the ſpring, it will be apt to burn the graſs, and inſtead of improving it, will thereby do it much injury for that ſeaſon. When uſed for corn land, it ſhould be ſpread before the laſt plowing, that it may be turned down for the fibres of the corn to reach it in the ſpring; for if it lies too near the ſurface, it will forward the growth of the corn in winter; and in the ſpring,

when

when the nouriſhment is chiefly wanted to encourage the ſtems, it will be nearly conſumed, and the corn will receive but little advantage from it.

Mr. Bradley[m] adviſed a gentleman to whom a conſiderable quantity of bark was left upon the expiration of a leaſe of a tan-yard, to lay ſome of it upon a piece of ſtubborn ſour land, which he did with ſuch ſucceſs, that his product was admired by all the gardeners and farmers in the neighbourhood. For ſuch ground, he thinks it ſhould be mixed with a ſandy ſoil; and that one third of bark to two thirds of ſand, will be a very ſufficient proportion for clays; laying on about an hundred and ſixty cart-loads upon an acre.

All barks or rinds of trees, though not of ſo high a value as that of oak, which is the ſort principally uſed by tanners, muſt of neceſſity enrich either corn or paſture-ground, if broken into ſmall pieces and laid upon it. They muſt needs be much richer than the mould or earth uſually found in the bodies of old, large, hollow willow-trees, putrefied within; though this is juſtly eſteemed very efficacious[n]. For the ſame reaſon, all ſorts of rotten wood, ſaw-duſt, fern, ſtraw, brake, ſtubble, ruſhes, thiſtles, leaves of trees, or any manner of vegetable traſh whatever, either caſt into the yard among the cattle or ſwine, or thrown into pools or places to rot, or mixed with other ſoils, muſt be good manures.—The lees of wine, and the grounds or ſettlings of beer, ale, &c. are of the like nature, but ſtill more excellent. In wine countries, the remainder of the grapes after they have been preſſed is found to be a very rich manure; and ſo are the remains of all ſubſtances out of which oil is made.

[m] p. 90. [n] WORLIDGE. p. 84.

Oil

"Oil cakes", that is, the cakes of lin-ſeed, rape-
"ſeed, &c after the oil has been preſſed out of
"them at the mills, are much uſed in ſome parts
"of Cambridgeſhire, and in the north part of
"Eſſex. Theſe cakes are then ground to powder
"in mills, ſtrewed upon the ground, and plowed
"in. A thouſand cakes, weighing about two
"pounds and a half or three pounds each, are
"enough to manure three acres, and will now coſt
"about three pounds ten ſhillings; though, but a
"few years ago, they uſed to be ſold for twenty
"ſhillings the thouſand. They are profitable to
"land, and help to bring luxuriant crops; though
"ſome think they hurt land afterwards, or, as old
"farmers ſay, the crops which are raiſed by this
"means are ſo extremely vigorous, that the
"very heart of the ground is deſtroyed. I am
"ſatisfied that what Virgil mentions concerning
"the excellency of the lees of oil in helping of
"corn, is founded on experience; and this ma-
"nure, containing many oily parts, muſt conſe-
"quently be very fit to promote vegetation: but
"to render it beneficial for more than one year,
"the beſt way is to mix it with fine earth, or ſand;
"for that will take off it's too great vigour, and
"be a means of bringing valuable crops, at the
"ſame time that the land will be preſerved in
"tolerable ſtrength."

Malt-duſt is accounted a great enricher of bar-
ren land, eſpecially if the ſoil be clayey. It proves
moſt beneficial when rain chances to fall ſoon af-
ter it has been ſtrewed, becauſe it is thereby waſh-
ed into the earth before it has loſt it's ſtrength.
The common cuſtom is to ſprinkle about forty
buſhels upon an acre of land, juſt after it has
been ſown with wheat or barley. In ſome parts

o BRADLEY, *p.* 95.

of

of Berkſhire, they ſow it with their wheat, and harrow both in together; a method which is found to anſwer very well. Some huſbandmen hold it to be better for ſummer corn, than for wheat; becauſe, ſay they, as the winter corn remains a whole year in the ground, and the malt-duſt will have ſpent it's ſtrength by the time winter is over, it will not be able to keep the corn in heart all the ſummer. In the common way, it ſerves only for one crop: but Mr. Bradley thinks [p] it might be rendered far more beneficial if it was to be mixed with ſandy or light earth, about a buſhel of duſt to five buſhels of earth; and then being equally ſpread upon the land, to be plowed in ſhallow, not exceeding the depth of three inches. It is likewiſe a great improver of cold graſs-ground.

Dyers dung is alſo commended as a very good manure for all ſorts of land. Two loads of it are ſufficient for an acre [q].

I ſhall cloſe this article with the following pertinent and judicious obſervation in Mr. J. J. Biberg's Diſcourſe on the Oeconomy of Nature, preſented to the Swediſh Academy at Upſal [r].

"The cruſtaceous *liver-worts* are the firſt foun-
"dation of vegetation, and therefore are plants of
"the utmoſt conſequence in the oeconomy of na-
"ture, though ſo deſpiſed by us. When rocks firſt
"emerge out of the ſea, they are ſo poliſhed by
"the force of the waves, that ſcarce any herb can
"find a fixed habitation upon them; as we may
"obſerve every where near the ſea. But the very
"minute cruſtaceous *liver-worts* begin to cover
"theſe dry rocks, although they have no other

[p] p. 94. [q] MORTIMER, p. 121.

[r] It was preſented on the 4th of March 1749, and is publiſhed in the ſecond Volume of the *Amœnitates Academicæ*. But not having that work by me in the original, I borrow the paſſage from Mr. Stillingfleet's tranſlation.

"nouriſh-

"nouriſhment, but that ſmall quantity of mould, "and imperceptible particles, which the rain and "air bring thither. Theſe *liverworts* dying at "laſt, turn into a very fine earth; and on this "earth the imbricated * *liverworts* find a bed to "ſtrike their roots in. Theſe alſo die after a ſhort "time, and turn to mould; and then the various "kinds of moſſes, ſuch as the *hypna*, the *brya*, the "*politricha* find a proper place, and nouriſhment. "Laſtly, theſe, dying in their turn, and rotting, "afford ſuch a plenty of new formed mould, that "herbs and ſhrubs eaſily root, and live upon it."

"That trees when they are dry, or are cut down, "may not remain uſeleſs to the world, and lie, as "it were, melancholly ſpectables, nature haſtens "their deſtruction in a ſingular way. Firſt the "*liverworts* begin to ſtrike root in them; after-"wards the moiſture is drawn out of them; "whence putrefaction follows. Then the *muſhroom* "kinds find a fit place for nouriſhment on them, "and corrupt them ſtill more. The *beetle*, called "the *dermeſtes*, next makes himſelf a way between "the bark and the wood. The *muſk beetle*, the "*copper-tail-beetle*, and the *caterpillar* or *coſſus*, bore "an infinite number of holes through the trunk. "Laſtly, the *wood-peckers* come, and, while they "are ſeeking for inſects, wear away the tree, al-"ready corrupted; till the whole paſſes into earth. "Such induſtry does nature uſe to deſtroy the "trunk of a tree! Nay, trees immerſed in water "would ſcarcely ever be deſtroyed, were it not "for the worm that eats ſhips, which performs "this office; as the ſailor knows by ſad expe-"rience."

* *Scaly*, having parts lying over parts, like tiles, as in the cup of the *thiſtle-flower*.

"*Thiſtles*, as the moſt uſeful of plants, are armed and guarded by nature herſelf. Suppoſe there were a heap of clay, on which for many years no plant has ſprung up: let the ſeeds of the *thiſtle* blow there, and grow, the *thiſtles* by their leaves attract the moiſture out of the air, ſend it into the clay by means of their roots, will thrive themſelves, and afford a ſhade. Let no other plants come hither, and they will ſoon cover the ground."

"All ſucculent plants make ground fine, of a good quality, and in great plenty: ſuch are the *ſedum*, the *craſſula*, the *aloe*, and the *algæ* *. But dry plants, like *ling* or *heath*, *pines*, *moſs*, &c. make it more barren; and therefore nature has placed the ſucculent plants on rocks, and the drieſt hills.

ARTICLE III.

Of Animal Manures.

ANIMALS, and every part belonging to them, yield the richeſt and moſt general of all manures. — "The fleſh of carrion, and dead animals, being already prepared by many curious elaborations of it's juices, is highly effectual [a]; but it ſhould be very well conſumed, and ventilated till it have quite loſt it's intolerable ſmell; and therefore ſhould never be applied too crude. Blood is excellent almoſt with any ſoil. It has been reported by divers eye-witneſſes, that after the battle of Bagnam fields in Devonſhire (where lord Hopton obtained a ſignal victory), the blood of the ſlain fertilized the land, which had been ſown with corn a little

* *Graſs-wrack*, or *Sea-weeds*.

[a] EVELYN, *p.* 319.

"while

" while before, to ſuch a degree, that moſt of the " wheat-ſtalks of the enſuing crop bore two, " three, four, nay ſeven, and ſome even fourteen " ears; a thing almoſt incredible. The owner of " the land, ſeeing how miſerably it had been " trodden down, thought of re-ſowing it; but was " diſſuaded from that deſign (perhaps to make " the experiment), and had the abovementioned " ſurpriſing crop."—This proves the great utility of the offals of ſhambles, which are too much diſregarded, for manure.

Mr. Evelyn [b] likewiſe gives it as Sir Hugh Plat's opinion, " that the blood and fleſh of ani- " mals is a much more powerful enricher of land, " than their dung and excrements, and is com- " puted at twenty times the advantage; that hair, " wool, bones, &c. have the ſame advance above " this; and that, as to the coarſer ſoils, the dung " of pigeons and poultry does as far exceed that " of beaſts which feed on groſs vegetables. To " this he adds, that it has been found upon expe- " rience, that one load of any ſeed contains as " much virtue as ten loads of ordinary dung; and " therefore the huſbandman will do well to ſave " all he can of the bottom, offal, and ſhakings of " corn-ricks, hay ſtacks, &c. when they are re- " moved, and to mingle it with chimney-ſoot " and blood, till he has brought it to the conſiſt- " ence of a paſte; to which may be added as " much dried neat's dung, tempered with urine. " This compoſt, being made up in cakes as big " as houſhould loaves, well dried in the ſhade, and " crumbled to duſt, will be a very conſiderable " improvement to the ground on which it is ſifted " or ſprinkled; I ſay ſprinkled, becauſe it ſhould " never be laid too thick, eſpecially for corn,

[b] p. 320.

Animal

"which it either cloys, or over-heats, according as "it is qualified. Thus, pigeons dung burns ſeeds "on hot ground, but it is excellent for barley, &c. "ſown on a colder mould."

All marrow-bones, fiſh-bones, hoofs, horns, or ſhavings of horn, or liquors wherein fleſh or fiſh have lain, or any other thing whatſoever that hath an oilyneſs or fatneſs in it, is uſeful in huſbanding lands [a]. —— Bones are moſt ſerviceable when raſped, or broken into ſmall pieces; and the beſt way of uſing the hoofs of cattle, is, as Mr. Ellis directs, to ſet them upright in the earth, that they may receive the rain, which, putrifying in them, and being waſhed out by ſucceeding ſhowers, communicates a great fertility to the ſurrounding ſoil. — Parings of leather, hides, feathers, fiſh, in ſhort, all animal ſubſtances whatever, are an excellent manure. — All ſorts of hair of beaſts being thinly ſpread or ſown, and ſuffered to putrify, makes a very great increaſe on corn-lands. This improvement will laſt two or three crops. It is generally reckoned beſt for barley, is of light carriage, twenty or thirty buſhels being enough for an acre, and is commonly ſold for about eight ſhillings a buſhel [c]. The people in New-foundland uſed to manure their ground with fiſh in Mr. Hartlib's time, as he tells us in his *Legacy*, which was publiſhed in the year 1655; and this practice is now followed with great ſucceſs, particularly for light ſoils, in ſome of the weſtern parts of England, where they have fiſh in much greater quantities than they can otherwiſe diſpoſe of. All oily ſubſtances contain a nouriſhing quality; and this is what Mr. Bradley [d] takes to be the part of the fiſh which chiefly contributes to the fertility of land, by helping to bind the open

Hair of beasts

[a] WORLIDGE, *p.* 84. [c] MORTIMER, *Vol.* I. *p.* 120.
[d] *p.* 99.

parts

parts of light ſoils, which then become capable of retaining it's virtues. M. Du Hamel[e] mentions the good and laſting effects of only the ſweepings of the rooms where they work in whale-bone.

Woollen rags, and the nippings of the pitch-marks upon ſheep, are a ſingularly good manure. The rags ſhould be chopped ſmall, about an inch or two ſquare, and ſcattered on the earth at the ſecond plowing; for being thereby covered, they will begin to rot by ſeed time. They imbibe the moiſture of dews and rain, retain it long, and, as Dr. Home obſerves, thereby keep looſe ſoils in a moiſt ſtate. They coſt about four pence a buſhel at London, from whence many loads are ſent every year to Dunſtable (which is thirty miles), where they are laid even on ſtiff lands[f], juſt after the ſowing of the corn, allowing to the acre four ſacks of ſix buſhels each.

Dungs are intended either to repair the decay of exhauſted worn out lands, or to cure the defects of other ſoils, which are as various in their qualities, as are the dungs that are uſed to meliorate or reſtore them[g]. Some lands are too cold, moiſt, and heavy; whilſt others are too light and dry. To anſwer this, ſome dungs are hot and light, as that of horſes, ſheep, pigeons, &c. Others again are fat and cooling, as that of oxen, cows, hogs, &c. And as the remedies which are uſed muſt be contrary to the diſtempers they are to cure, ſo the dung of oxen, cows, and hogs, ſhould be applied to lean, dry, light earths, to make them fatter and cloſer; and hot and dry dungs to cold, moiſt, and heavy lands.

Dung has two peculiar properties. The one is, to fatten the earth and render it more fruitful;

[e] *Tom.* VI. *p.* 193. [f] MORTIMER, *Vol.* I. *p.* 120.
[g] MILLER's *Gardener's Dict. Art.* DUNG.

and the other, to produce a certain ſenſible heat, capable of cauſing ſome conſiderable effect; which laſt is ſeldom found but in the dung of horſes and mules, while it is newly made, and a little moiſt.

Horſe-dung, the leaſt fat of any, is the moſt fiery, if taken freſh as it falls, and the moſt apt to excite a ſudden fermentation; for which reaſon it is then fit only for the hot-bed. When this heat is paſt, it may be ſpread on fields where we would have a rank graſs to ſpring: but it ſhould not by any means be admitted into the garden, or where we would wiſh to have good roots, unleſs the ground be very ſtiff, cold, or wet, and then too it ſhould be well rotted, leſt, inſtead of correcting the ſoil, it leave couch, and other pernicious weeds, worſe than the diſeaſe itſelf; the ſeeds of hay, and of other plants, which the horſes eat, coming oftentimes entire from them: for thoſe vegetables which cattle chiefly eat, commonly ſpring up from their dung; as long knot graſs from this beaſt; ſhort, clean, and ſweet paſture from ſheep and cows; the ſow-thiſtle from ſwine. Ground mucked with horſe-dung is always the moſt infected of any; and if it be not perfectly conſumed, it makes your roots grow forked, fills them with worms, and gives them an unpleaſing reliſh: but if laid on at the beginning of winter, and turned in at ſpring, it ſucceeds ſometimes with pulſe [h].

Horſe-dung is greatly improved by being mixed with it's oppoſite cow-dung, which is cold and fat; and this mixture is conſiderably meliorated if mixed with a proper earth, with mud, or with aſhes and urine. Cow-dung alone, is the worſt of all dungs to endure wet, becauſe it is the moſt eaſily diſſolved. But neither of theſe dungs, either ſingly, or mixed as above, ſhould be uſed till it is old;

[h] EVELYN, *p.* 317.

nor

nor ſhould it be laid abroad expoſed to the ſun and wind, as is the practice of ſeveral injudicious farmers, who let it lie ſpread on their field-lands during three or four of the ſummer-months, till the ſun and air have exhauſted all it's virtue: whereas, if it be laid in heaps, mixed with earth, and left in that ſtate till it be rotten, it will be the ſooner brought to a proper temper, will produce a ſweeter graſs when laid on paſture-grounds, and will go much farther than in the common way when ſpread before the plough for corn, of which it will then greatly promote the growth[i].

Mr. Miller ſays he has frequently ſeen new horſe-dung buried as it came from the ſtable, in very cold moiſt land, and always obſerved that the crops have ſucceeded better, than where the ground was dreſſed with very rotten dung.

Sheeps dung and deers dung are nearly of the ſame quality, and are generally eſteemed the beſt of all dungs for cold clays. Some recommend beating them into powder, and ſpreading them very thin over autumn or ſpring crops, about four or five buſhels to an acre, in the ſame manner as aſhes, malt-duſt, &c. are ſtrewed. But this light dreſſing does not laſt long. The moſt common way of conveying it upon land, is, by folding of the ſheep themſelves upon it, by which means their urine is ſaved as well as their dung, which ought to be turned in with the plough as ſoon as poſſible, that it may not lie expoſed to the heat of the ſun. In Northamptonſhire, they think it beſt to fold ſheep after July, and to fold them the lateſt upon dry land. In ſome parts of France, where they likewiſe fold their cows and oxen, the place of folding is changed twice every night[k].—In Flanders, they houſe their ſheep at night in places ſpread with clean

[i] WORLIDGE, *p.* 69. [k] *Maiſon Ruſtique, Tom.* I. *p.* 601.

ſand, about five or ſix inches thick, which, being laid on freſh every night, is cleared out once a week. This mixture of ſand and dung makes an excellent dreſſing for ſtrong land; for the dung and urine of the ſheep is a very rich manure. M. Quintinie thinks it the greateſt promoter of fruitfulneſs in all ſorts of ground. This method of folding ſheep in a covered fold, and of mixing their dung with earth, ſand, &c. according to the nature of the ſoil it is intended for, is likewiſe, very properly, recommended by Mr. Mortimer; who adds[l], that he has known vaſt crops of rye upon barren lands that have been old warrens, well dunged by rabbits; and large oak and aſh upon the ſame, though the ſoil was very ſhallow.

Next to ſheeps dung, the preference is generally given to that of ſwine, one load of which will go as far as two loads of other dung. The laying it on too thick may perhaps have occaſioned the old miſtaken notion of it's breeding more weeds than any other dung[m]; for all dungs will make weeds ſhoot up; whether they contain within themſelves ſeeds of thoſe plants, not ſo thoroughly digeſted by the animal as to be deprived of their vegetative power, as may ſometimes be the caſe; or by the additional fertility which they communicate to the earth. — This dung is beſt when carried from the ſtye directly to the field, where it is a rich manure both for corn and graſs, eſpecially the latter, and for almoſt any ſort of land. Hot ſands and gravel are particularly benefited by it; and it is reckoned a very great fertilizer of fruit-trees. Many good huſbandmen perfer this dung before moſt ordinary ſorts of manure, and take great care not only to have their

[l] *Vol.* I, *p.* 114. [m] WORLIDGE, *p.* 80.

hog-yards well paled and paved with pebbles, or other ſtones, or with chalk, which is much the beſt; but alſo to increaſe the quantity of the dung as much as they can, by throwing into the ſtye all the ſtraw, fruit, beans, roots, plants, weeds, &c. which are the refuſe of the garden, with the offals of the kitchen, and every kind of traſh; all which is not only very good for the hogs themſelves, but increaſes their dung to ſuch a degree, that ten or twelve ſwine have yielded ſixty or eighty loads of excellent manure in a year. Some notable farmers will make their hog-yards produce them an annual profit of twenty or thirty pounds[n]. Mr. Worlidge thinks this the beſt of dungs to prevent or cure the canker in trees; and Mr. Mortimer[o] eſteems it beſt for manure, when mixed with horſe dung; for which reaſon he adviſes placing the hog-ſtye as near the horſe dung-hill as can conveniently be.

The farmers in Staffordſhire frequently ſow on poor light ſhallow land, a ſmall white pea, which they never reap, but turn in as many hogs as they think the crop will fatten, and let them lie upon it day and night. The dung and urine of theſe animals enriches the land ſo much, that it ſoon acquires a thick ſward, and continues to be good grazing ground for ſeveral years[p].

In this light, of reaping a double advantage from the manuring of land, the author of the New Syſtem of Agriculture[q] adviſes huſbandmen to ſow ten or fifteen acres of their ground with turnip ſeed, a little before they ſow clover, which, he thinks, is beſt done in September: then, towards the beginning of March, to take the beſt opportunity to buy three hundred ſows; all ſuch as will farrow in about a month. Let little ſties,

[n] WORLIDGE, *p.* 70. [o] *Vol.* I. *p.* 115. [p] *Id. ibid.* [q] *p.* 212.

formed

formed of boughs or reeds, be made for them in the moſt convenient parts of the clover ground, either in the corners, or under the hedges of theſe fields; and let the ſows be kept up, and fed daily with the turnips which were ſowed the autumn before. At firſt, it will be neceſſary to take the trouble of boiling them, tops and all, and of giving them in the troughs with the water not yet cold: they may afterwards be only ſcalded; and in a week or ten days the ſwine will eat them raw, with the greateſt greedineſs and pleaſure. In the beginning, or towards the middle of April, theſe ſows will farrow; after which they muſt not be fed with turnips any longer than till the clover is pretty high, when they and their pigs may be turned in among it. It is impoſſible for one, who has not ſeen it, to imagine how eagerly the ſwine will graze on clover, which increaſes their milk to ſuch a degree, that the pigs ſhoot forward at a double rate; and, as they leave off ſucking, they too take to feeding on the clover, by which they proſper ſo faſt, that, by the end of October, every pig will fetch twenty or five and twenty ſhillings, in any market. The treading of great cattle is apt to break the ſtalk of clover graſs, and they ſpoil, by trampling it down, a much greater quantity than they eat: but ſwine are never hurtful this way; and if there be any fear of their rooting up the ground, that may be eaſily prevented, by a ring in their noſes; though our author ſays he never knew a hog break up an inch of clover. They graze upon it with more pleaſure, than they could root.

Human ordure, is a very fat and hot manure, full of fertilizing ſalts, and therefore extremely proper for all cold ſour ſoils, eſpecially if it be mixed with other dung, ſtraw, or earth, to give it a fermentation, and render it convenient for carriage.

Some do not like to uſe it on account of it's bad ſmell; and others imagine that it gives a fetid taſte to plants: but in this they ſeem to carry their delicacy rather too far. It is uſed with great ſucceſs in many parts of France, all over Flanders[e], and, I believe, not leſs profitably round about London. Mr. Bradley ſays[f] it is kept in pits, made on purpoſe, in foreign countries, till it be one, two, three, or four years old; that that of four years is accounted the beſt, that of three years tolerable, but the others not ſo fit for uſe; and that the perſons concerned in theſe pits pay great regard to the place from whence they have it, preferring that which comes from towns where the moſt fleſh is eaten, as the ſtrongeſt and richeſt manure. — It certainly ſhould not be laid on too new, nor in too great quantities; becauſe it is of a very hot nature: but when that heat is tempered by age, putrefaction, and a due mixture with other ſoils, it becomes a rich and excellent manure. Perhaps it may owe great part of this richneſs to the urine with which it is mixed: for though human urine be deſtructive to vegetables, whilſt it is new, by reaſon of it's burning ſal-ammonical ſpirit, as Glauber terms it; yet, as in many other moiſt things ſubject to putrefaction, time will correct that defect, digeſt the urine, take off it's fiery quality, and ſo alter it's nature as to render it an extraordinary fertilizer of every kind of ſoil. Columella certifies that old urine is excellent for the roots of trees. Mr. Hartlib commends the Dutch for preſerving the urine of cows as carefully as they do the dung, to enrich their lands; and inſtances a woman he knew near Canterbury, who ſaved in a pail all the urine ſhe could, and when the pail was full, ſprinkled it on her meadow,

[e] *Maiſon Ruſtique*, p. 602. [f] p. 98.

the

the graſs of which looked yellow at firſt, but afterwards grew ſurprizingly. Similar to this is what Mr. Bradley relates [t], as of his own knowledge. Human urine was thrown into a little pit conſtantly every day, for three or four years. Two years after, ſome earth was taken out of this pit, and mixed with twice as much other earth, to fill up a hollow place in a graſs walk. The turf which was laid upon this ſpot grew ſo largely and vigorouſly, beſides being much greener than the reſt, that, by the beſt computation he could make, it's graſs, in a month's time, was above four times as much in quantity as that of any other ſpot of the ſame ſize, though the whole walk was laid on very rich ground. The author of the *Engliſh Improver*, is therefore very right in ſaying, that human urine is of greater worth, and will fatten land more, than is generally imagined by our farmers, whom he adviſes, to take all opportunities of preſerving this, and every ſort of urine, for their ground, as carefully as is done in Holland.

The dung of all poultry is of a very hot nature, full of volatile ſalts, and therefore extremely fit for cold lands. Being light of carriage, and a little of it going a great way, it is moſt commonly uſed for diſtant grounds, where it is ſprinkled on wheat or barley, after they are come up, or upon this laſt at the time of ſowing. Mr. Mortimer [a] thinks forty buſhels ſufficient for an acre. It is uſed to moſt advantage when dried and powdered, and is very efficacious to keep froſt out of the earth [b]. It's effects are ſudden, but does not laſt long. Hens dung is very rich, though not ſo hot as pigeons dung; nor is it ſo eaſy to ſow, becauſe it hangs more together; neither can it be ſo readily collected. The opinion that gooſe-dung is

[t] *p.* 99. [a] *Vol.* I. *p.* 116. [b] EVELYN, *p.* 70.

rather

rather hurtful than beneficial to corn or graſs, is an ancient error, as is proved by Mr. Worlidge [c], who ſays he was credibly informed that a flock of geeſe having made a track croſs a field of wheat, in the winter, and nibbled the corn clean from the ground in their daily paſſage, at the ſame time dunged this paſſage in ſuch manner that the wheat upon it proved the next year much finer than on any other part of the field. This he likewiſe confirms by an account of a flock of wild-geeſe, which pitched upon a parcel of green wheat, and reſted there ſeveral nights, till they had eaten up all the blades; but dunged the land ſo effectually, that the wheat ſprung up again with redoubled vigour, and produced a far richer crop than any of the adjacent fields. As to the wholeſomeneſs of gooſe-dung, Mr. Mortimer inſtances [d] a field which was given to the town of Sutton in Nottinghamſhire, for feeding geeſe, whoſe dung made it one of the richeſt paſtures he ever ſaw, inſomuch that all ſorts of cattle coveted much to feed upon it; nor could he find by any of the inhabitants, that the beaſts ſo fed had ever received the leaſt injury from it. He adds, that his own horſes, kept in a piece of paſture on which geeſe lay very much, eat the graſs bareſt where theſe fowls had dunged moſt, and that he never found it do them any hurt, except making them too fat. Dr. Leigh, in his Natural Hiſtory of Lancaſhire and Cheſhire [e], ſays that Fowley Iſland is ſo improved by the dung of fowls, that it fats ſheep in a very ſhort time, worth 50 s. or 3 l. a piece.

The falſe notion that the dung of geeſe occaſions barrenneſs, has probably ariſen from it's having been laid on too thick; for it is of a very hot and fiery nature: but if ſpread thin in the winter,

[c] *p.* 71. [d] *Vol.* I. *p.* 117. [e] *p.* 56.

it

it will prove a very rich and valuable manure, eſpecially if mixed with cooling earth, and let putrefy ſome time. The ſame may be ſaid of the dung of any other water-fowl [f].

Huſbandmen ſhould obſerve as a conſtant rule, that the hotteſt dungs do beſt when ſpread thin and early; and that the colder ſorts ſhould be laid on thicker and later [g].

ARTICLE IV.

Of Compoſts.

NATURE preſents to us a compoſt ready prepared, conſiſting of the putrid particles of vegetables and animals mixed with the fineſt and richeſt mould, in the ſcouring of ponds and ditches, and often in creeks of the ſea. This, not coming naturally under any of the former heads, requires our notice here, as a manure of very great uſe for almoſt every ſoil; eſpecially the light and dry. The mud of ditches in particular, ſhould be expoſed to the air for ſome time, that the ſeeds of weeds generally contained in it may have time to vegetate, or putrefy, before it is laid on land. The authors of the *Maiſon Ruſtique* [h] direct keeping all theſe ſubſtances a year or two, expoſed to the heat of the ſun, and to froſt; a precaution which may be very neceſſary in regard to the ſea-ooze, in order to open it's ſalt-ſlime, and render it the more eaſily miſcible with the ſoil on which it is laid: — though this end may be obtained in a ſhorter time, and perhaps to greater advantage, by mixing it with dung or lime.

Mr. Worlidge [i] recommends particularly a mud or ſludge which he calls ſnail-cod, or ſnag-greet,

[f] WORLIDGE, *p.* 71. [g] EVELYN, *p.* 318. [h] *Tom.* I. *p.* 603. [i] *p.* 68.

as

as a manure of which one load will go as far as three of the beſt horſe or cow-dung. It lies frequently in deep rivers, is very ſoft, full of wrinkles, and intermixed with many little ſhells, and ſnails, to which it is thought to owe great part of it's fatneſs. All rivers, unleſs their water be very clear and their current pretty rapid, ponds, pools, and ſtagnating waters, of which that of rain is beſt, afford a very rich mud; being the ſoil of paſture fields, commons, roads, ſtreets, ſinks, or back-ſides, waſhed down till it finds a place of reſt, where it coſts nothing but the labour of taking it away, which it will amply repay, eſpecially if laid upon dry gravels or ſand. The cleanſing of the ſtreets of great cities is an almoſt ſimilar, and extremely beneficial manure.

In collecting manures from time to time, as they come to hand, farmers generally keep them together in what they call dung-hills, where they remain expoſed to the heat of the ſun, the waſhing of rain, and drying winds; by which means all their virtue is drawn forth, and carried away. Mr. Evelyn juſtly cenſures this wrong practice, and at the ſame time gives the following directions [i] for making a ſtercorary, to contain the compoſt collected by huſbandmen.

Dig a ſquare or oblong pit, of a ſize ſuited to the quantity of compoſt wanted, or proportioned to the extent of the ground intended to be manured. Let the ſide next the fields be made ſloping, ſo as to receive a cart to load or unload eaſily. Let the bottom be well paved, and both the ſides lined, unleſs it be made in a bed of clay or chalk, that it may be capable of retaining water like a ciſtern; for it is of great importance, as Columella obſerves [k], that the dung be well ſoaked in

[i] *p.* 326. [k] *Lib.* I. *c.* 7.

liquor,

liquor, in order to deſtroy the vegetative faculty of the ſeeds of weeds which may chance to be mixed with it, or the litter. If channels, or gutters, can be directed to this pit, from the ſtables and offices about the houſe, they will be of great ſervice. Mr. Evelyn is of opinion that this ſtercorary ſhould be under cover, ſo as at leaſt to hinder down-right rains from falling upon it: — But if care be taken to make the pit in a place where no running water, or ſprings can come to it; and if the farmer covers the dung, as it is collected, with a coat of mould, to prevent the ſun's exhaling, or the rain's waſhing away it's richneſs; I cannot help thinking that the quantity of water which falls in rain, would not be more than is requiſite to moiſten the mixture, and bring on that putrid fermentation which is neceſſary for the due incorporating and perfecting of the compoſt. It will, however, be right to have a ſhade to put over it occaſionally, in caſe the ſeaſon ſhould prove extremely wet. — Columella informs us[1], that the Romans covered their ſtercoraries with hurdles; but does not ſpeak of covering them with mould, as here directed.

The pit being thus prepared, the farmer's next ſtudy ſhould be to fill it with a compoſt ſuited to the nature of his land. Thus, if his ſoil is a ſtrong clay, a layer of dung ſhould be covered with a layer of ſand, rubbiſh of old houſes, or other ſubſtances already mentioned for the improvement of clay. Litter of all kinds becomes a good addition, becauſe it is ſlow in decaying, and if mixed with the clay, keeps it's parts aſunder. The compoſt for meliorating clay may be carried out, and mixed with the earth, freſher than for any other ſoil; becauſe, in this ſtate, it will more effectually

1 *Ubi ſupra.*

keep

keep the particles of the clay ſeparated; and if ſome degree of it's putrefaction is carried on in the ſoil, it will much more powerfully open it. — If, on the contrary, the ſoil is ſand, the dung ſhould be mixed with clay, ſcouring of ponds, or other fat ſlimy ſubſtances, which may give conſiſtence to the ſand. And if the farmer is happy in a ſoil in which neither of the extremes prevail, he may then mix his manure with the richeſt mould he can find, and incorporate them well together, by frequent turning, before the compoſt is carried to the field. — Columella [k] thinks they are ſlothful huſbandmen, who, in thirty days, have not a load of dung, of twenty buſhels, from each of the leſſer cattle, and ten loads from each of the larger ſort, by means of judicious mixtures with their dung. He thinks this mixture, or compoſt, moſt benficial to corn, after it is a year old; becauſe it ſtill retains all it's ſtrength, and does not then breed weeds.

"Many good effects, particularly that of hindering the oils from being volatilized, and of fixing them, will ariſe from a mixture of lime with theſe compoſts, after they are thoroughly rotted [l]. But as many experiments have proved that quick-lime powerfully reſiſts putrefaction, it does not ſeem judicious to mix it with dung-hills which are not ſufficiently putrefied, as it muſt ſtop that proceſs."

"There is a very great attraction betwixt quick-lime and all oily bodies [m]: it unites intimately with expreſſed oils. With this intention it is uſed in the manufacture of ſoap, to help the junction of the alkaline ſalts and oils. It muſt, therefore, attract the oils powerfully from the air and earth, diſſolve them, and render them miſcible with

[k] *Lib.* II. *c.* 15. [l] Dr. Home, *Principles of Vegetation*, *p.* 70, 71. [m] *Idem. p.* 69.

water: it muſt, from this reaſon, ſoon exhauſt the ſoil of all it's oleaginous particles, if the farmer does not take care to ſupply them by dung or animal ſubſtances. Farmers have, by experience, diſcovered it to be a great impoveriſher of lands; but they did not know how it acted. It's operation is, to exhauſt the earth of it's oils. The proper cure for this is, to mix dung with the lime, ſo that it may have ſomething to act on."

"Lime is a great diſſolver of all bodies, both vegetable and animal [n]; but particularly the latter. We know how ſoon it reduces hair and woollen rags into a pulpy ſubſtance. This effect is ſo ſtrong, that, in the common method of ſpeaking, it is ſaid to burn them. In this way it certainly operates in the earth, by diſſolving all animal and dry vegetable ſubſtances, and converting them to the nouriſhment of vegetables, at leaſt ſooner than otherwiſe they would be. — Like other calcarious bodies, it is not diſſolvable but by acids [o]. With theſe, a great effervеſcence happens, a ſolution of the calcarious body is made, and a neutral ſalt is formed from that conjunction. This neutral ſalt is always ſoluble in water, unleſs where the acid of vitriol is uſed."

The *Society of Improvers in the Knowledge of Agriculture in Scotland*, have paid great attention to the ſubject of compoſts, and are very particular in their inſtructions on this head, to ſeveral of their correſpondents. I gladly take this opportunity of paying the tribute of praiſe juſtly due to their public ſpirit, and congratulate them on the great ſucceſs which has attended their labours in many parts of their country. At the ſame time I cannot help regretting, that, though all our neighbours have ſet us ſo many examples of periodical inſtruction in this moſt uſeful art, there is not yet

[n] *p.* 70. [o] *p.* 68.

any

Composts

any inſtitution of that kind in England. It is to be hoped, that the *Society for the Encouragement of Arts, Manufactures and Commerce*, will ſoon take off this reproach, and not ſuffer it to be longer ſaid that Agriculture lies neglected in this kingdom, where the people enjoy every advantage requiſite to promote it, in a far higher degree than the inhabitants of any other country in the world. The wealth of our farmers is incomparably greater; their property, and the tenure of their land, are infinitely better ſecured; and the happieſt of ſoils and climates combine to reward their labour.

The Society in Scotland give to a gentleman who had written to them, and who had clay and lime at command, the following judicious directions for collecting a compoſt, or making a ſtercorary, for the improvement of a ſandy ſoil. "Take, ſay they [p], in the field intended to be manured, a head-ridge, the moſt conveniently ſituated for a ſtercorary. Plow it two or three times, as deep as can be, in the cleaving way, if the ridge be high gathered, and harrow it well: then lay thereon your ſlimy clay, about a foot thick, leaving a part of the ground un-covered: next lay a thin layer of dung, another of clay, and after that a layer of un-ſlaked lime, at leaſt a foot thick: then throw up the earth left uncovered on each ſide. After this, repeat another layer of clay, and lime-ſtone, as before, and finiſh it with a layer of clay and ſea-wreck, covered with earth. The more of the ſlimy clay the better: for though it may be cold, yet it will not be the worſe for a ſandy hot ground. If you examine the clay, we doubt not but you will find it a very fat ſubſtance; being, as we conjecture, moſtly muſcle and other ſhells mixed with earth, brought by the

[p] MAXWELL's *Collection*, *p.* 26.

tide and river Southeſque. On the coaſt of Lothian, we found that ſlimy ſubſtance to be nothing elſe; and if it be ſo with you, it is certainly one of the beſt manures."

"After this ſtercorary has ſtood ſix weeks or two months, incorporating and fermenting, turn and mix it; and that this work may be performed to the better purpoſe, and with as ſmall an expence as poſſible, yoke your plow, enter upon your ſtercorary with a cleaving furrow, and continue repeating the plowings the ſame way, until the very bottom of the ſtercorary be ripped up; then harrow it: it is impoſſible to over-do it. If it be very cloddy, it ſhould be harrowed between the plowings. Begin then in the middle, and plow again and again in the gathering way, until it be brought into as narrow bounds, and be raiſed as high as poſſible. Let all that the plow has left be gathered up, and thrown with ſhovels on the top. Every ſuch turning and heaping occaſions a new ferment, and improves the manure. If the ſeeds of barley, or of any other quick-growing vegetable, were ſprinkled thin on the ſtercorary, and the plants buried in it, when fulleſt of ſap, before they come to ſeed, by turning or more heaping, the manure would be improved." This might be repeated ſeveral times in the courſe of the ſeaſon; for the practice has been found ſucceſsful.

In another place [q], they obſerve that ſuch a ſtercorary may be turned in the ſame manner as ground is trenched. The higher it is raiſed, the better. Each turning will make it heat like a garden hot-bed, and this fermentation will reduce it to a fine fat mould. If the firſt heat ſhould go off (which may eaſily be known by thruſting a pole into it) before it has produced this effect, it may

[q] p. 136.

be

be turned over again, and will take a new heat, which is of great advantage to it, beſides the better mixing of the ſeveral manures. About fifty or ſixty cart-loads of this compoſt are uſed upon an acre of ground. — I have been the more particular in extracting this account, becauſe any farmer, by attending to the rules here given, may ſuit his compoſt to the nature of his ſoil. Where the ſoil varies, he will do well to have another ſtercorary, properly compoſed, in a convenient part of the field he intends to manure.

The ſame Society, in their directions* for the management of ſheeps dung, where the ſheep are houſed, or fed under cover during the inclemency of the winter, adviſe laying under them ſubſtances ſuited to the nature of the ſoil intended to be improved. A layer of ſand, for inſtance, for ſtiff land, will be greatly benefited by being covered with a couch of litter in the ſheep-houſe. When their dung becomes troubleſome or offenſive to them, or begins to make them dirty, the whole ſhould be removed to the ſtercorary. But if the dung of the ſheep is to be laid on a ſandy ſoil, clay, or any ſuch ſubſtance, though covered with litter it would ſoon become wet, and too cold for the ſheep to lie on. It would therefore be better, in this caſe, to ſpread a thick couch of litter under the ſheep, and mix this in the ſtercorary with the lime, &c. by which means the ſame advantage may be obtained, without injury to the cattle. If loam, or a rich mould, be laid under ſheep, the judicious farmer will be careful to collect a ſufficient quantity of it, when it may be got dry, in the ſummer. Whatever is uſed for this purpoſe, ſhould be renewed as often as it is ſufficiently

* Interſperſed in ſeveral parts of Mr. Maxwell's Collection, particularly in *p.* 159, 240, *and* 275.

impregnated by the urine and dung of the ſheep.

The well preparing of mixed dung, is, as Mr. Worlidge rightly inſiſts [r], a piece of huſbandry by no means to be neglected; for the more and better the dung is, the greater will be the crop; and an increaſe of the crop will augment the quantity of dung. On the contrary, a decay in the dung makes a decay in the crop, &c. The riſe, or fall, of the value of many farms in this kingdom muſt therefore neceſſarily depend upon the good or bad management of this eſſential part of huſbandry.

Farmers, eſpecially if they live in countries which do not abound in cattle, may be apt to aſk, where they are to get ſufficient quantities of dung for the purpoſes thus ſtrongly recommended? M. de Turbilly, who pre-ſuppoſes this objection, anſwers it, by pointing out the following method of making an artificial manure [s]. His directions are ſo clear, eaſy, and judicious, and at the ſame time ſo pertinent to the preſent ſubject, that I ſhall not heſitate to give them here at full length, for the benefit of our Engliſh huſbandmen; eſpecially as I ſhall have frequent occaſion to refer to them in future parts of this work; particularly in the account of that gentleman's deciſive experiments, which will be given in the next chapter.

"Before the winter ſets in, that is to ſay, by the middle of November at fartheſt, huſbandmen ſhould cleanſe all the yards, and out-lets belonging to the farm-houſe, lay them ſmooth, and, if neceſſary, dig away a little of their ſurface, till it be about a foot lower than the floor of their buildings. Then, if they have any common, or waſte land, let them bring from thence fern, thiſtles,

[r] p. 85. [s] *Memoire ſur les Déſrichemens*, p. 78.

and

and other coarſe weeds, cut down when in full ſap, at which time they are beſt, or occaſionally as they are wanted, and lay a bed of them, about two inches thick, upon the places thus prepared. If weeds cannot be got, coarſe wheat or rye ſtraw may be uſed in their ſtead, in beds about half as thick. A layer of earth, about ſix inches deep, ſhould be ſpread upon this bed of weeds, or ſtraw. Earth of a quality proper for the improvement of the ſoil intended to be manured, is undoubtedly the beſt; though any earth, which in this caſe the farmer will dig as near to the houſe as he conveniently can, is preferable to the miſtaken practice of paring off the upper ſoil, or turf, of the neareſt common or waſte land, to mix with the artificial manure: for when poor ground has loſt it's ſurface or ſward, it long remains a barren ſpot, before a new ſoil, capable of affording root and nouriſhment for graſs, can be formed upon it. If no proper earth lies nearer at hand, the farmer may take off the ſurface of any part of his plowed ground which lies too high, and is not at too great a diſtance. But, as much as poſſible, he ſhould adapt the earth mixed with this manure, to the nature of the land for which it is intended."

"This bed of litter and earth ſhould be let lie about a fortnight, during which all ſweepings and filth of the kitchen and houſe ſhould be thrown upon it, that nothing may be loſt, which can be converted into manure. The wetneſs of the ſeaſon, and the paſſing of men, cattle, and carriages, over this bed, will greatly contribute to rot it; to complete which, let the farmer turn in all his cattle of every kind, and drive them backward and forward over it, after rain has fallen. This will ſoon render it a kind of coarſe mud mixed with litter, which may be cleared away at

the end of another fortnight. If it be too liquid, as it often is in rainy ſeaſons, it ſhould be laid up in little heaps, upon the ſame place, till it be drained. Let it then be carried to a ſufficiently capacious hole, or pit, dug for the purpoſe in or near a corner of the farm-yard. This pit muſt be in a dry place; for no manure ſhould ever be laid in water, which would waſh away it's unctuous parts, deſtroy it's heat, diſſolve it's ſalts, and even leſſen it's bulk conſiderably if it run off elſewhere. One load of ſtable and other dung ſhould be mixed with every two loads of this artificial compoſt, as it is laid in the pit. The next day, another bed of litter and earth may be ſpread in the yard, &c. as before; and, being managed in the ſame manner, will be fit for carrying to the dung-pit in about another fortnight. Thus two ſupplies of this artificial dung may be had every month, during the whole winter and part of the ſpring."

"This work will not be expenſive: every body, even women and children may be employed at it, and it is done at a time of the year when labourers are leaſt wanted in the field. It may be continued in the ſummer: though the beds do not rot near ſo ſoon in dry weather; two or three months being ſometimes requiſite then, to bring them to a proper ſtate, in the above method. However, this may be conſiderably haſtened, and much improved, by bringing cattle to lie upon them in the night, unleſs they are in folds. The earth and other ſubſtances of this manure will be greatly enriched by their dung and urine, before it is carried to the ſtercorary.

"As this laſt made dung will not be ſufficiently rotted by the next ſowing ſeaſon, the beſt way is to lay it in a ſeparate pit, to mellow, for the enſuing year; and it will be ſtill better, if kept

two

two years. The other dung, made in a wetter ſeaſon; and more thoroughly putrefied at firſt, ſhould remain about ſix months in the pit, to ripen; and be wetted now and then in dry weather. During this time, it heats, ferments, and acquires an excellent quality. It may be made to ſuit any ſoil, and agrees with many lands better than pure dung taken from the ſtall or ſtable, than which it is milder, leſs fiery, and more laſting. Farmers who have not a large yard belonging to their houſe, may make this compoſt in any other place that beſt ſuits their convenience; and the poorer ſort of peaſants may do the ſame. By mixing with it a third part of other dung, they triple their quantity of manure."

This eaſy and profitable method of making artificial dung is likewiſe recommended by the ingenious author of the *Diſſertation on Agriculture*, publiſhed in the *Memoirs* of the truly laudable *Society eſtabliſhed at Berne, for the Improvement of rural Oeconomy* [a].

"There are, ſays he, two ways of meliorating land. One of them may be called natural, and the other artificial. The former conſiſts in a well proportioned mixture of two or three different kinds of earth, the reſult of which is a new ſort, more favourable to vegetation; and the latter in dung.

"Dung conſiſts of animal or vegetable ſubſtances, either actually putrefied, or in a ſtate of putrefaction. It operates two ways upon the earth: firſt, by conveying nouriſhment to the plants which grow in it, as the air and water alſo do; and ſecondly, by opening it's pores and ſeparating it's parts, by a kind of fermentation, till at laſt it is itſelf converted into a kind of fine black mould.

[a] *Tom.* II. *Par.* 3. *p.* 651.

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"The only way to have plenty of this uſeful matter, without much expence, is by a mixture of ſtraw or litter with the excrements of animals. Manure may be obtained from every part of animals or vegetables: but a quantity ſufficient for a large extent of ground, would coſt too much. I therefore ſhall not here ſpeak of ſaw-duſt, tanner's bark, aſhes, ſoot, linen or woollen rags, ſhavings of horn, &c. of which quantities can be had only in the neighbourhood of populous towns; but ſhall content myſelf with pointing out the means of increaſing dung in countries diſtant from great cities.

"Agriculture affords an ample field, and very abundant matter, for the moſt uſeful of all experiments. Nothing would contribute more effectually to it's improvement, nay, to the reducing of it to fixed and certain rules, than for proper perſons to try upon different pieces of ground, of ſimiliar ſize and ſoil, ſome of the principal methods pointed out by the moſt intelligent in this art, and compare the iſſue of their trials, and the ſeveral incidents attending them, during a courſe of years. This is particularly wanted in order to determine the effects, and the quantity moſt proper to be uſed, of different manures. To this end, two or three *Fields of Experiment* might be ſet apart, to be cultivated exactly according to a well choſen and well digeſted plan. An exact account ſhould alſo be kept of every occurrence, diſburſement, and produce. — Regularity is the ſoul of all buſineſs. — Such journals, properly methodized, would give us a clear inſight into rural Oeconomy, and ſet order, aſſiduity, and frugality in ſo advantageous a light, that every one would be forced to acknowledge them to be the ſource of riches, and, as ſuch, would be induced to practiſe them."

SECT.

SECT. IV.

Of the Improvement of MOORS *and* BOGGY-LAND.

BEFORE mankind were numerous enough to cultivate the ground ſo univerſally as it now is in Europe, the ſurface of the earth was covered with trees and other plants, moſt of which died and rotted where they grew. Their leaſt periſhable parts mixed with the native mould, and formed, by degrees, that new ſurface, called *Mooriſh Earth*, which is generally met with on large extended plains. This was particularly the caſe where clay, or other ſubſtances impervious to water, lay under the ſuperficial mould. Where the ſurface was ſand, theſe vegetable, and ſometimes animal, putrefactions ſunk through the mould, and probably formed that rich fertile ſubſtance which is always found under ſand and gravel and is diſtinguiſhed by the name of *Marle*, in this work: tho', at the ſame time I am of opinion that there is a calcarious ſubſtance called Marle, which is nearly a-kin to chalk, as was obſerved in ſpeaking of Marle. *This* Marle muſt not be confounded with that which is often found in places that were formerly the beds of rivers, or receptacles of great bodies of ſtanding water. In theſe, the marle is chiefly compoſed of ſhells, now almoſt totally diſſolved, and mixed with the fineſt earth. The marle here meant, on the contrary, ſhews no ſigns of ſhells, but ſeems rather to conſiſt of the fineſt earth, and the ſaline and oily particles of animals and vegetables, waſhed down by the rain, and intimately blended together. Theſe oils account for it's unctuous feel, as the ſalts do for it's eaſy ſolution in water.

This

This opinion is greatly confirmed by the channels which are frequently traced through ſand and gravel, plainly indicating a deſcent of ſuch matter; and by the marle's being always richeſt, the deeper we dig into a bed of it.

Where theſe ſubſtances are retained on the ſurface, the finer parts, in the other caſe waſhed through the ſand, here become volatile, and leave their coarſer and more durable particles to form the *mooriſh* earth.

Where trees and ſhrubs have died thus, and fallen, eſpecially in a hollow place where water has been confined among them, their putrefaction goes on more ſlowly. In the mean time, fine rich mould is brought by winds, by water deſcending from higher grounds, &c. which, gradually mixing with the water and the vegetable ſubſtances already buried in it, acquires in time a conſiſtence which gives riſe to certain plants, and thus proceeds till the whole is converted to that ſolid ſubſtance called *Peat*. In this caſe, the oils of the vegetables, and of many animals which periſh in the water, are intangled in the rich mould mixed with the water; and their total putrefaction being prevented by the mineral acid in the water, they become of that bituminous quality which is found in peat.

As large tracts of the ſurface of the earth are covered by one or other of theſe moulds, which, not being an original ſoil, could not be comprehended under either of the diviſions already treated of, they deſerve our particular attention here. In order to proceed with regularity, it will be neceſſary, firſt to deſcribe what is meant by *Moors*, and *Boggy Land*; next to give directions for draining them; and then to point out the means by which they may be improved.

I ſhall here have an opportunity, which I embrace with pleaſure, of communicating to my countrymen the excellent inſtructions on theſe heads contained in the *Memoirs* of the *Society* eſtabliſhed at *Berne for the Encouragement of rural Oeconomy*: a Society which well deſerves the higheſt commendations, for the public ſpirit and the judgment ſhewn in their publications. The *Memoir* on this ſubject[a] is ſo complete, that I ſhall ſeldom depart from it. Wherever I do, my authors will be particularly mentioned.

ARTICLE I.

Deſcription of Moors and Boggy Land.

THE moſt common of theſe lands is that which is called *Moor*. It is a very fine black mould, and is ſometimes found under a pretty thick ſward of graſs, but more frequently under moſs, or ſtraggling plants of heath. It differs from peat, in that it does not ſtick together, nor has the fibrous roots, or bituminous viſcous quality of this laſt. Peat, when dry, becomes hard and firm: this falls into powder. It cannot be better deſcribed, than by comparing it to that ſubſtance which is found in hollow rotten willows and other trees of that kind; which gives room to think that it ariſes from rotten plants. It is of a ſpungy nature, and ready to imbibe moiſture, which adds conſiderably to it's weight. There is generally underneath it, as under moſt earths of this kind, a bed of clay, or ſome ſubſtance impervious to water: ſo that the particles of bodies decayed on their ſurface, not being admitted into the ſoil, remain upon that ſurface, dry there, and

[a] *Tom.* II. *Par.* 2. *p.* 243.

increaſe it's thickneſs, according to the continuance of the cauſe.

If this kind of ſoil is collected in a place where running water, in rainy ſeaſons, brings with it clay, or other fat ſoils, from the neighbouring grounds; it then acquires a greater degree of coheſion, hardens when dry, and reſembles the cleanſing of ponds, more than the former.

The moſt conſiderable ſoil of this kind is the ſort called *Peat*. This is uſually full of roots of weeds, and even of trunks and branches of trees and other plants. It always contains a bituminous oil, which renders it very inflammable when dry; at which time it alſo becomes very hard, though it is quite ſoft when in the mine, if I may be allowed to give that name to the bed in which it lies; for there it is eaſily cut in the form of bricks, as we ſee it when uſed for fuel.

"The whole maſs and body of this ſoil is a dunghill [a], made up of rotten timber, graſs, weeds, and often mud waſhed from the higher grounds about it, by the land-floods; than which there are few richer compoſts: only by age, and it's cold ſituation in water, pent in about it by the neighbouring riſing grounds, it's ſalts are weakened, and it's ſpirits become languid — The ſame will happen to the richeſt dunghill that can be made of any compoſition whatever, if too long kept. It will even become ſuch as not to be diſtinguiſhed, by the eye, from ordinary moſs; nor will it be more uſeful, as dung, except either in proportion to the ſhorter time it has been kept, or the better ſituation of the place where it has ſtood.—I believe the qualities of moſſy grounds differ very little from one another in any other reſpect, than with regard to the better or worſe quality of the mud which

[a] MAXWELL, *p.* 38.

makes

makes a part of their compoſition. They are more or leſs ſpungy, in proportion as this rich mud fills up the cavities of the component vegetables, which are preſerved from putrefaction by the acid in the water. The leſs ſpungy, and the more rotten the moſs is, the fitter it is for the vegetation of any thing planted in, or ſown on it."

Mr. W. King, in his account of *Bogs* in Ireland, publiſhed by the Royal Society [c], imputes the true cauſe of them to want of induſtry; as a proof of which he inſtances a large tract of ground in the county of Connaught, which was plowed land when O Donal and Tirone laid waſte that country, in their march to the relief of Kingſale, and now is a bog, in the midſt of which the old manſion houſe ſtill remains.

"The ſprings, ſays he, with which Ireland abounds, are generally dry, or near dry, in the ſummer time, and graſs and weeds grow thick about the places where they burſt out. In the winter, they ſwell, run, and ſoften and looſen all the earth about them. The ſward or ſcurf of the earth, which conſiſts of the roots of graſs, being lifted up and made fuzzy by the water in the winter (as I have ſeen it lifted up a foot or two at the head of ſome ſprings), is dried in the ſpring, and does not fall together, but withers in a tuft, through which ariſes new graſs; which is alſo lifted up the next winter. By this means the ſpring is more and more ſtopt, and the ſcurf grows thicker and thicker, till at firſt it make that which we call a *quaking bog*; and as it grows higher and dryer, and the roots of the graſs and other vegetables become more putrid, together with the mud and ſlime of the water, it acquires a blackneſs, and grows into that which we call a *turf bog*.

[c] *Philoſoph. Tranſ. No.* 170.

I believe that when the vegetables rot, the ſaline particles are generally waſhed away with the water, as being apt to be diluted in it. The oily, or ſulphureal, are thoſe which chiefly remain, and ſwim on the water; and this is that which gives turf it's inflammability."

"I muſt confeſs that there are *quaking-bogs* cauſed otherwiſe. When a ſtream or ſpring, runs through a flat, the paſſage, if not tended, fills with weeds in ſummer, trees fall acroſs it and dam it up: then, in winter, the water ſtagnates farther and farther every year, till the whole flat is covered. Afterwards, a coarſer kind of graſs ſhoots up, peculiar to theſe bogs. This graſs grows in tufts, it's roots conſolidate together, and it's height increaſes every year; inſomuch that I have ſeen it as tall as a man."

"This graſs rots in winter, and falls on the tufts, and with it the ſeed, which ſprings up the next year, and ſo ſtill makes an addition. Sometimes the tops of flags and graſs are interwoven on the ſurface of the water, and this becomes by degrees thicker, till it lie like a cover on the water: then herbs take root in it, and by the matting of their roots it becomes very ſtrong, ſo as to bear a man. I have gone on bogs which would riſe before and behind, and ſink where I ſtood, to a conſiderable depth; under which was clear water."

As a farther proof that want of induſtry is the principal cauſe of bogs, Mr. King obſerves, that the higheſt mountains in Ireland being full of ſprings, and un-inhabited, are over-run with bogs, as well as the plains, becauſe no care is taken to clear the ſprings.

"Ireland, continues he, abounds in moſs, more than, I believe, any other kingdom. This moſs is of divers kinds, and that which grows in bogs is remarkable. The light ſpungy turf is nothing but

but a congeries of the threads of this moſs, as I have frequently obſerved, before it be ſufficiently rotten. (The turf then looks white, and is light.) I have ſeen it in ſuch quantities, and ſo tough, that the turf-ſpades could not cut it. In the north of Ireland, they call it *Old-wives tow*, being not much unlike flax. The turf-holes, in time, grow up with it again; and all the little gutters in bogs are generally filled with it. To this I chiefly impute the *red*, or *turf* bog; and from the ſame cauſe even the hardened turf, when broken, is ſtringy; though there plainly appear in it parts of other vegetables: and I am almoſt (from ſome obſervations), tempted to believe, that the ſeed of this bog-moſs begets heath when it falls on dry and parched ground. However, the moſs is ſo fuzzy and quick growing a vegetable, that it greatly ſtops the ſprings, and contributes to thicken the ſcurf, eſpecially in red bogs, where I remember to have obſerved this moſt particularly."

A flat ſpot of ground, lower than the level of an adjoining river or lake, may alſo give riſe to a bog; for when that part is filled up by the ſlime and earth brought from the ſurrounding grounds, and the rotten plants and animals, which are buried in it, have choaked it up, it will become a bog; and then the water will continue to flow into it from the river or lake, eſpecially when either of theſe is ſwelled by a fall of rain, or the melting of ſnow. Theſe waters may alſo ſometimes have this effect without a communication above ground, by ſoaking through a ſandy or gravelly ſoil.

Another cauſe of Bogs has frequently ariſen from the fall of a number of trees, which, lying neglected, have neceſſarily occaſioned a ſtagnation of the water brought down from higher grounds; ſo that the earth and other ſoil conveyed with it, have of courſe remained among the

fallen wood, and given birth to a moſſy ground, which, it is plain from hence, is not an original ſoil. Coarſe graſs, and weeds which cattle will not eat, ſpring up in theſe places, and die there, after ſhedding their ſeeds, which, being prevented from rotting by the bituminous acid in the moſſy water, produce new plants; ſo that, this being repeated every year, an annual addition is made to the depth of the moſs.

A remarkable inſtance of this conſequence of the fall of trees is thus related by Lord Cromartie, in a letter to the Royal Society [a].

"In the year 1651, a little plain, on the ſide of a ſteep hill, was covered over with a firm ſtanding wood, which was ſo very old, that not only the trees had no green leaves, but their bark was entirely thrown off. Fifteen years after, or thereabout, I had occaſion to ſee the ſame place, and called to mind the old wood which I had noticed before. At this time, there was not ſo much as a tree, or the appearance of the roots of any; but in place thereof, the whole bounds where the wood had ſtood was all over a plain green ground. I aſked the country-people who were with me, what became of the wood? They told me, that it being all over-turned from the roots by winds, the trees lay ſo thick, that the moſs had overgrown them; adding, that it was occaſioned by the moiſture which came down from the hill, and ſtagnated upon the plain. Before 1699, the whole piece of ground was turned into a common moſs, where the peaſants dig turf and peats. The peats, as yet *, are not of the beſt, being ſoft and ſpungy; but they grow better and better."

[a] *Philoſoph. Tranſ. No.* 330.

* At the time of Lord Cromartie's giving this account.

Another

Another inſtance, of the ſame kind, is thus related in the Tranſactions of the ſame Society [b].

"Abundance of oak, fir, and other trees, has been frequently found in the *Moor* in that fenny tract, called the iſle of Acholme, lying part in Lincolnſhire, and part in Yorkſhire. Some of theſe oaks are five yards in compaſs, and ſixteen yards long; others are ſmaller and longer, with good quantities of acorns ſtill lying near them, ſomewhat above three feet deep, and about their roots, which yet ſtand as they grew, in firm earth, below the moor: many of the firs, which lie a foot or eighteen inches deeper than the oaks, and in greater numbers, are thirty yards long. One of them, taken up not many years ago, meaſured thirty ſix yards, beſides the top, lying alſo near the root, which ſtood as it grew. Mr. Dugdale thinks that this place has been a moor for many ages, and that the original cauſe of it was the muddineſs of the tides, which, flowing up the Humber into the Trent, left in time ſo much filth, as to obſtruct the currents of the Idle, Dun, and other rivers, which thence flowed back, and ovewhelmed the flat country.

The bottom of bogs is generally a kind of white clay, or rather ſandy marle. A little water makes it exceeding ſoft; and when it is dry, it is all duſt. The roots of graſs do not ſtick faſt in it; but a little wet looſens them, and the water eaſily gets in between them and the ſurface of the earth, which it lifts up, as a dropſy does the ſkin. It is more than probable, that great quantities of ſhell-marle may be found under moſs, eſpecially where the ſea has formerly flowed.

As to their ſituation, the *mooriſh* earth often lies on flat eminences, moſt commonly where there is

[b] N°. 67.

no ſtagnating water. If water does ſtagnate there, the ſoil becomes the richer. *Peat* grounds are generally found where there has been a depth of ſtanding water, occaſioned either by a hollow on the ſurface, or by the current's being ſtopt, as in the inſtance given by Lord Cromartie. The rich paſtures along the banks of the Trent, have probably been formed by the ſame means; for when ſwampy lands have been covered with a bed of earth, brought to them from higher grounds, by inundations, they often become excellent meadows, amply ſtored with very fine graſs.

ARTICLE II.

Of Draining Boggy Land.

AMONG the many and great inconveniencies which neceſſarily ariſe from Bogs, Mr. King, ſpeaking of Ireland in particular (and the ſame will hold good in any other country), mentions the following, as cogent reaſons why every endeavour ſhould be uſed to bring them, firſt to a leſs hurtful ſtate, and afterwards to a condition in which they may be of ſervice to mankind.

"The fineſt and ſmootheſt plains [b], which generally ſhould be meadows, are often covered with uſeleſs, too often with really pernicious, bogs. Theſe bogs are a great deſtruction to cattle, the chief commodity of Ireland. In the ſpring time, when the cattle are weak and hungry, the edges of the bogs are commonly cloathed with graſs, and the beaſts, in ventering to get it, fall into pits or ſloughs, where they are either drowned, or, if they are found, hurt, and often maimed, in the

[b] *Philoſoph. Tranſ. No.* 170.

pulling

pulling out. — The fogs and vapours which ariſe from theſe places are commonly putrid, ſtinking, and very unwholeſome: for the rain which falls on them, ſtagnating upon their ſurface, and in their hollows, (than which there is hardly any ſubſtance, equally ſoft, more impenetrable by water,) corrupts there, and is exhaled by the ſun; ſo that, very little of it running off, it muſt of neceſſity affect the air. — They corrupt other water, both in it's colour, and taſte: for the water which ſtands in the pits, or lies on the ſurface of the bog, is tinctured by the reddiſh-black colour of the turf; and when a ſhower comes, ſo as to make theſe pits overflow, the water which runs from them tinges all it meets, and gives its colour and ſtench even to many rivers. — The only advantage derived from any kind of bog, is, turf for fuel. It makes a tolerably ſweet fire, in the common way of uſing it; and is, when *charred*, perhaps the ſweeteſt and wholeſomeſt thing that can be burnt, fitter for a chamber, and for conſumptive people, than either wood or coal."

"All the inconveniencies of our bogs, continues Mr. King, may be remedied and they may be made uſeful to us, *by draining:* for I never obſerved one bog without a fall ſufficient to drain it, nor do I believe there is any. The great objection againſt this improvement is the expence; in which I cannot but think that people are often terrified without ſufficient cauſe. — One trench will drain many acres in *quaking* bogs, which, when dry, are generally meadow, or the beſt grazing ground. — Every *red* bog has about it a deep, marſhy, ſloughy ground, which is called the bounds of the bog. A deep trench round ſuch a bog keeps out cattle, and turns the bounds into good meadow. I remember a *red* bog of ſixty acres, which a gentleman reduced to good grazing

ground, worth three ſhillings an acre, for twenty-five pounds, which is leſs than three years purchaſe. — In all improvements of this kind, gentlemen ſhould conſider, that what they lay out, goes by degrees, ſo that they ſcarcely feel it; that it goes among their tenants, whom it helps to enable to pay their rent; that they do a work of charity, in employing the poor; and that they at the ſame time contribute to both the ornament and general profit of the kingdom."

"The deep trench before mentioned, round a *red* bog, not only drains and improves the bounds of the bog, as I ſaid before, but goes a great way towards drying the bog itſelf. It ſerves likewiſe as a common ſink, into which all the drains vent themſelves. Theſe drains ſhould be cut ſo as to croſs the little ſloughs that run in the bog. The firſt drains ſhould not be above two or three feet deep, or wide: for the bog is ſo ſoft, that deep trenches will not ſtand, but fill up again. When the ſurface of the bog is cut in little trenches, ſuppoſe at twenty, thirty, or forty perches diſtance, it will ſoon be ſo dried that cattle may graze on it all the ſummer. A year or two after this, by which time the bog will be ſomewhat dry towards the ſurface, the drains may be made ſix feet wide, and as deep as the ſoftneſs of the bog will permit. This will certainly make the bog uſeful for grazing: and at the end of another year or two, an attempt may be made to cut one or two of the trenches down to the bottom of the bog; for till that be done, I do not reckon the bog ſecured. A gentleman may oblige all his tenants to cut their turf in theſe trenches, and likewiſe have his own cut there."

Small bogs may be turned to very good account by planting them with oſiers, willows, and alders: but where the extent is conſiderable, this

object

object becomes of too little conſequence. Before they can be improved in any other way, they muſt be drained: as a previous ſtep towards which, it will be neceſſary to examine from whence their too great quantity of water ariſes, and what retains it. When the cauſes are known, their effects will be the more eaſily remedied.

The ſources from whence the too great quantity of water proceeds, may either be without, or within the bog. The mooriſh earth eaſily admits rain-water, and if it's ſurface be flat, may retain it a conſiderable time. But ſtill rain can hardly be reckoned one of the cauſes here. Where this kind of earth is bordered by higher grounds, either rain or running brooks from thence, may overflow it, but the moſt uſual ſources are within itſelf, occaſioned by ſprings which riſe in the bog. This is eaſily diſcovered by the greater moiſture in one place than in another, and by obſerving that the water ſpreads from thence, even under the ſurface, as through a ſponge.

If the water from without comes from neighbouring grounds, it is uſually kept off by a ſurrounding ditch, made large enough to contain the quantity that may at any time flow down, and by carrying that ditch to the moſt convenient outlet, according to the declivity of the ground. If the bed of gravel, or ſand, through which the ſprings within the bog run, be cut quite through, the ſource of thoſe ſprings will certainly be deſtroyed; and if that bed be only opened in digging this ſurrounding ditch, the water will ſo readily diſcharge itſelf thereby, that the ſprings will probably be dried up.

Before any drain is made in the bog itſelf, a level of the ground ſhould be taken; and when the too great moiſture proceeds from a ſpring or ſprings within the bog, a large ditch ſhould be

made, beginning at the loweſt part of the bog, where an outlet can be had, and continued from thence to the ſpring. If the bog be firm enough to bear it, this ditch ſhould be dug down to the very bottom of the bed on which the peat or moſs is formed, which, in caſe of ſprings, is always gravel or ſand, with, generally, a bed of clay underneath. If the whole of the ditch cannot be of that depth, it certainly ſhould at the ſpring itſelf, thereby to give a ſufficient vent to all the water which is brought through that gravel or ſand: for otherwiſe the water may force itſelf a paſſage in another part, and ſo make it neceſſary to extend the ditch thither. If there be more ſprings than one, the main ditch muſt be extended to each of them. In all caſes, the ſureſt way is to dig the ditch, where it can be done, at leaſt a foot deeper than the ſpring lies. Between the principal ditches cut in the bog, there ſhould be ſmaller, emptying themſelves into thoſe larger, to carry off any remnant of ſtagnating water, and to preſerve the ſurface dry. Care ſhould be taken not to lay the earth dug out of any of theſe ditches too near their ſides, leſt it's weight ſhould make them fall in.

Bogs are generally higher than the land about them, and higheſt in the middle; the chief ſprings that cauſe them being commonly about the middle, from whence they extend by degrees, and puff up the earth in ſuch manner, that people are often apt to think the ſprings lie deeper than they really do. A ſure way to know whether the ditch be deeper than the ſpring, is, to obſerve whether the water comes in at it's bottom, or through the ſides. The width of the ditch, I ſpeak particularly of a main ditch, ſhould be proportioned to it's depth; and both will, in a great meaſure, depend upon the quantity of water neceſſary to be drained. In general, it ſhould widen progreſ-

ſively

Draining Bogs

ſively from it's head to it's outlet, becauſe the bulk of water in it will be conſtantly increaſed. The ſides of the ditch ſhould always be dug ſloping; more or leſs according to the nature of the ſoil. If the ground be very looſe and light, and conſequently very liable to crumble and fall in; it will ſometimes be neceſſary to make the ſlope ſo great, that the top of the ditch will be four times as wide as it's bottom. If the ſoil be ſtiffer, the ſlope may be leſs; but no ditch ſhould ever be dug quite perpendicular.

If a deep trench be cut through a bog, the original ſpring will be found, vaſt quantities of water will iſſue from it, and the bog will ſubſide. Mr. King ſays [b] he was informed that the bog at Caſtle Forbes, where this was done, ſubſided thirty feet; that this great fall ſeemed, indeed, incredible; but that he found, by computation, that it could not be much leſs than fifteen.

Mr. Eliot's contrivance to drain a piece of ſhaking meadow, as he calls it [c], containing about forty acres, deſerves to be noticed, for the ſingularity as well as uſefulneſs of the invention. The ſurface of this ground, over-run with cran-berry vines and wild graſs, ſeemed to be only a ſward of their roots laid over a very pappy mud, and was deemed ſo poor that no body would rent it. At the only out-let of this meadow, there was a ſufficient fall, but very rocky; ſo that it was neceſſary to dig four or five feet deep to take advantage of it. In March, when this gentleman went to make the out-let drain, the torrent of water was ſo great, that nothing could be done in the uſual way. He thereupon ordered a tree to be felled a-croſs the brook, and pieces of plank, the end of which reſted upon this tree, to be driven down a-ſlant into the mud. The chinks and crevices of theſe

[b] *Philoſoph. Tranſ. No.* 170. [c] *Eſſay* I. *upon Field-Huſbandry, p.* 7.

planks

planks were then closely stopped with tow, by which means the water was shut into the meadow. The trench or main ditch was then worked at in the day, and the water was let out at night, till the drain was completed. When the weather grew sufficiently warm, and the meadow was a little settled, cross ditches were cut, one on each side, and another in the middle, and, so far as they extended, the meadow soon became firm and dry. "Some," adds Mr. Eliot, "are deterred from "such an undertaking as that of draining their "land, by reason of the great charge. They terri-"fy themselves without reason. When I was "about to cut my main drain, some thought it "impossible; others, that it would cost at least an "hundred pounds. The place was full of rocks, "some of which we dug up, others were broken "with steel wedges, and others were blown up "with powder. The whole expence did not ex-"ceed twenty pounds."

When the ditches and trenches are finished, great care must be taken to keep them in a good and lasting condition, lest all the labour bestowed upon them should be lost. There are different ways of doing this. If the the ditches are left open, they must be well cleansed of weeds and mud twice every year, in the spring and in autumn. It will also be right to drive in from space to space, along the inside of their banks, strong stakes of oak or alder (being woods which do not easily perish in water), to strengthen them, and keep them from falling in. Willows, which delight in a watery soil, may be advantageously planted upon these banks, which their roots will help to keep up and bind.

If a bog be so entirely surrounded with high grounds, as not to have any declivity whatever, by the help of which it's waters may be drained off; ditches must then be dug round it, to receive the water from the neighbouring hills, and a very large

large deep pond muſt be made in the middle or loweſt part of the bog itſelf, for it's waters to run into; to facilitate which, great trenches ſhould be cut from the ſurrounding ditches to this pond, and channels, communicating with theſe trenches, a-croſs different parts of the bog. Their number and ſize will depend on the greater or leſs wetneſs of the ground. — When the water is thus collected, engines muſt be uſed, to raiſe it to a proper height for a channel to carry it off.

I ſhall ſelect out of M. Belidor's magnificient work upon *Hydraulics*, two or three of the ſimpleſt and beſt inventions for this purpoſe.

Fig. 2. *Plate* II[a], repreſents a mill which turns to every wind by means of the vane *A*. This vane is made of thin boards, well joined together. The upright beam *B* is ſolidly fixed in the earth. All the reſt of the machine turns with the vane. The inclined beam *CD* turns with the ſails, and with it the ſcooped wheel *D*, which is fixed to it, and deſcends a little way into the water; but not ſo deep as to touch either mud or earth, becauſe this would obſtruct it's motion. The beam *B*, which is the center upon which the whole of this engine reſts, muſt be fixed in ſuch manner that the wheel *D* may have full liberty to turn every way; to which end it is beſt to dig a circular ditch, ſomewhat deeper than the loweſt ſprings or water in the bog. This engine does not throw the water up higher than ſix or ſeven feet at moſt; but, to compenſate for this, it throws up a vaſt quantity; no leſs than 21572 pounds, which are equal to about 308 cubical feet, of water in an hour; when the wind is ſo favourable as to turn the ſails 587 times in that ſpace, which M. Belidor thinks the utmoſt exertion of their power.

[a] *Architecture Hydraulique, Tom.* II. *Chap.* 2. *Pl.* 1.

Each

Each of the ſails of this mill ſhould be ſeven feet long and four wide, which makes a ſurface of 28 feet, and conſequently 112 feet for the four ſails. The vane *A* ſhould be 16 feet and a half long, from the pivot *E* to it's extremity *F*, and ſix feet high from *F* to *G*, which gives a triangular ſurface of 49 feet and a half, beſides the corner next to the pivot *F*, which is here left uncovered in order to ſhew the frame to which the boards are faſtened; but which ſhould be covered when this engine is uſed. This triangular ſurface of 49 feet and a half, being larger than any ſide ſurface of the ſails, will neceſſarily turn the mill round till the wind catches them in front.

The meadows in Holland are full of mills conſtructed upon theſe principles; only the wheel which ſcoops up the water is ſomewhat different from this, being compoſed of a number of paddles hollowed like a ſpoon, as in *Fig.* 3.

It is here ſuppoſed that throwing the water out to the height of ſix or ſeven feet, will be ſufficient to convey it into a channel by which it will be carried off: but where the water requires being raiſed higher, a pump will be neceſſary.

Fig. 4. *Plate* II[b], is a ſucking pump, worked by the ſails of a windmill. It has this advantage over the former engine, that it will raiſe water much higher: but as the action of the ſucker depends upon the greater or leſs velocity of the ſails, the quantity of water raiſed by it will of courſe depend on the wind and diameter of the bore of the pump. A vane, as in the former, turns all the frame-work *ABCD* with the ſails, ſo that theſe laſt face the wind from wherever it blows; only the body of the pump itſelf being immoveably fixed.

[b] *Id. ibid.*

When

Draining Bogs

When the water is raiſed to the ſpout *E*, which, if neceſſary, may be placed 30 feet higher than the ſurface of the pool or ſtream, it runs out into a trough, which conveys it to the channel intended to carry it off. This pump may be uſed, not only for draining bogs, but alſo for raiſing water for gardens, meadows, caſcades, &c.

When the quantity of water is greater than this pump can raiſe, M. Belidor recommends[c]

Fig. 5, *Plate* II, another engine of the wind-mill kind, for draining bogs. It conſiſts of an axis, *CD*, in which the ſails are fixed. This axis, which turns on it's own center in *L* and *M*, is placed in ſuch manner that it does not touch the fixed upright beam *A*, round which the whole machine turns as directed by the vane. There muſt therefore be a circular ditch *BB* around this mill, that the buckets may always dip into the water. The axis *CD* muſt be bored through, from *C* to it's extremity *D*, to receive the water raiſed by the buckets, and convey it into the circular trough *KK*, which reſts upon poſts ſtrengthened by croſs bars, in order that, whatever ſide the ſails be turned to, the pipe *D* may deliver all the water it contains: and that the pipe *F*, which receives the water from the circular trough, in order to convey it to the intended place, may not interrupt the motion of the ſails of the mill, when they happen to be on that ſide, the hollow tube *GF* is added, that thoſe ſails may have a free paſſage. As the axis *CD* is more loaded on the ſide *C*, than on the ſide *D*; a proper equilibrium may be preſerved, by faſtening weights to the extremity of the vane.

As the moſt eſſential part of the operation of this machine conſiſts in making the water fall from

[c] *Ibid. Pl.* 2.

the

the buckets into the channel bored in the middle of the axis *CD*, a ſection of the wheel which carries the chain of buckets is given in *Fig. 6.* This wheel is divided into four parts, ſeparated by partitions of deal, which anſwer to four ſquare openings, like *c* and *d*, made in the nave where it is faſtened to the axis. In the inſide of each of theſe openings is a ſmall iron or copper valve, which opens and ſhuts by it's own weight: for example, as the chain of buckets turns, ſuppoſe in the direction indicated by the arrows round this figure, each bucket, when near the top of the wheel, empties itſelf into the partition *a b c* which anſwers to it; and then the valve *f* of the hole *c* which belongs to this partition, is open, to give a paſſage to the water which runs into the pipe: a moment after, as ſoon as the wheel has made half a turn, this hole, which was open, to let the water run into the pipe, is ſhut again by the weight of it's valve, as at *g*; but as there are four of theſe valves, which open and ſhut one after the other, the water will always find one of them open, to give it a paſſage into the pipe.

The higher the water is raiſed by this wheel, the leſs will be the quantity drawn up in the ſame ſpace of time, becauſe the chain of buckets will be proportionably longer; and as the force of the ſails can raiſe but a certain quantity at a time, the buckets muſt be the ſmaller; for in proportion to the greater quantity of water drawn up, the ſlower will be the motion; ſo that what is gained in quantity, is loſt in time. Each of the ſails of this mill ſhould be eight feet and a half long from *O* to *P*, and five feet wide; ſo that the ſurface of each will be 42 feet and a half ſquare, and that of the four, 170.

The greateſt quantity of water that this wheel can raiſe, in the ſhorteſt ſpace of time, will be

Scale of 15 feet. for Fig. 4.

0 5 10 15

Fig. 4.

A B C D I

Fig. 1.

Fig. 3.

N K K G F P B B

Scale of 18 feet. for Fig. 3.

6 12 18

Scale of 18 feet. for Fig. 2.

6 12 18

Fig. 2.

S O R L E B D

Fig. 3.

Fig. 6.

Scale of 3 feet. for Fig. 6.

3 6 9 12 inches 24 36

J. Goldar sc.

about 56 pounds in all the buckets, taken together, on one ſide, from the ſurface of the water *B*, to the top of the wheel *N*; and this, ſuppoſing it to turn with the greateſt rapidity poſſible, which, according to M. Belidor's calculation, will be 17 times and a half in a minute, and conſequently about 1050 times in an hour, will raiſe 39375 pounds, equal to 563 cubical feet, of water in that hour.

Land which lies lower than the level of a neighbouring river or lake apt to be overflowed by deſcending rains or the melting of ſnow, is often covered with a boggy earth. In order to drain this land, it muſt be fenced from the river or lake. This naturally leads us to the ſubject of banking, whether to keep out a river, lake, or the tide of the ſea.

Sloping banks are the beſt ſecurity againſt any encroachments of the ſea, of rivers, or of lakes; making proper allowances for the different weight of water, and violence of waves. Theſe banks ſhould be raiſed about two feet above the level of the water at the higheſt tides, and their ſtrength ſhould be proportioned to the force of the water intended to be fenced off. When a river is too much confined, it ſwells conſiderably upon a flood, and conſequently requires banks of greater height and ſtrength than would otherwiſe be neceſſary; though it will ſometimes break even theſe, and carry all before it, if a ſufficient ſpace be not allowed for the increaſe of it's water: but when ſuch a ſpace is left, the waters ſpread, and ſeldom riſe more than two or three feet above their uſual level. In ſome caſes, a breadth of fifteen or eighteen feet, on each ſide, may do; but in others, fifty, eighty, or an hundred feet, or perhaps ſo many yards, according to the largeneſs of the river, muſt be left open for that purpoſe. It is beſt to err on the

ſafe

ſafe ſide; eſpecially as the ground that is left between the banks and the river will be far from being loſt; for it will afford good grazing in the dry ſeaſons of the year, and may be planted with oſiers, willows, and other aquatics, which, beſides the profit ariſing from them, will be of uſe to ſhelter the banks from ſtorms and floods: but, as the *Dublin Society for the advancement of Agriculture and Manufactures* very juſtly obſerve[a], none of theſe ſhould ever be planted upon the banks, leſt the winds ſpoil and tear them, by ſhaking the trees and looſening their roots.

In the iſle of Ely, it is common to ſee great banks diſtant one or two hundred yards on each ſide from the channel of the river; and when they are ſo made they are always ſafe: but where the diſtance between the banks is narrow, there, and there only, the banks are in danger of being broken down, and the country of being overflowed.

If a conſiderable body of water is to be guarded againſt, dig a trench ten or twelve feet wide, and two or three feet deep, or more, according to the height and breadth of the bank required. Lay all the ſoil that is taken out of this trench, on that ſide of it which lies toward the water, and leave a ſpace of two or three feet between the trench and the foot of the bank. Let the bank be made with an eaſy ſlope of 15 or 18 feet in length towards the water, allowing the ſlope two and a half or three feet fall to one in height; but the inſide ſlope need not be more than eight or nine feet, which is a foot and a half ſlope to one foot perpendicular. The bank thus raiſed five or ſix feet high, according as the floods require, will be two feet wide at the top, where it ſhould be well flatted, that people may walk upon it. Let it then be

[a] *No.* XVII. *for April*, 1737.

covered

covered with gravel dug out of the channel of the water, by which means the river will be deepened and the bank ſtrengthened; and, to add to this laſt advantage, ſow it very thick with hay-ſeed. This is much better than turfing it with ſods taken from off the trench or other neighbouring ground; becauſe ſods are apt to ſhrink, open, and part from one another in dry weather, and are then liable to be waſhed away by the next tides; whereas in this much cheaper way, a cloſe covering of graſs, even long enough to mow, will be formed in a month or two; far fitter than ſods to break the force of the waves, and prevent their waſhing away the ſurface of the bank: for any tolerable ſoil may be brought to an immediate coat of graſs, by only raking it fine and ſowing it thick with hay-ſeeds. In a week or ten days in the ſpring, or ſummer, the graſs will be up, and grow to ſuch a height in a month or ſix weeks, as to be fit for mowing.

Some have attempted to guard againſt inundations by building walls of ſtone and lime; and others, in the ſame view, have raiſed perpendicular banks of ſods; but after they had been at an exceſſive expence in this management, they ſoon found all their works deſtroyed; the waters, bearing with great force on ſuch upright walls and banks, carried all before them: but when they flow on an eaſy and gradual aſcent, and meet with no reſiſtance, they cannot do much harm.

The broad trench within the bank, beſides affording materials for making the bank and ſlopes, is attended with the farther advantage of ſerving for a drain to the inland ground. Theſe trenches ſhould always be carried as far as the banks, particularly when theſe laſt are intended to fence off a riſing tide; and in the loweſt part of the ground, a ſluice with a valve, flap-door, or flood-gate

ſhould be placed in the bank, where it will both diſcharge the inland water, when the tide is out, and prevent it's flowing in. The ſeaſon of the year freeſt from floods ſhould be choſen for making theſe banks, that the ditch may have time to grow firm before heavy rains come on. It is likewiſe adviſeable to be as expeditious as poſſible in this work. If it is begun in a dry ſummer, and finiſhed in a month or two, as it may be, there will be little danger of being interrupted, by extraordinary tides or violent ſtorms, either of which might do more harm in one day, than could be repaired in a fortnight. — The exact dimenſions of the bank, and of the ditch within it, cannot be preciſely aſcertained by any general rule; becauſe both tides and floods riſe to different heights, and have different force, in different places and circumſtances. The ſtrength before mentioned may be ſufficient for the banks in common caſes: but in others, where a very great body of water, or a powerful tide is to be ſtemmed, they ſhould be, as the *Memoirs* of the *Berne Society* adviſe [a], four feet, or more, wide at the top, with a baſis proportioned to their height as three and a half are to one, or, if it be deſired to make them ſtill more ſolid, as four to one; ſo that if the bank be four feet and a half high, it's baſis in the former caſe will be fourteen feet wide, and in the latter eighteen: always obſerving to make the greateſt ſlope towards the water.

"Lord Limerick [b] has recovered between four and five hundred acres of very rich ſalt marſh, at Dundalk in Ireland, and effectually ſecured them from the ſea, by ſuch banks as are here deſcribed; and by the ſame method many hundred thouſand acres have been recovered from the ſea in Cambridgeſhire,

[a] *Tom.* II. *Part.* 2. *p.* 262. [b] *Ibid.*

bridgeſhire, Lincolnſhire, and other parts of England; not to mention the low-lands of Holland, which indeed are ſecured againſt the violence of the ſea by no other means."

"If there be a neceſſity of making banks on a ſtrand, where nothing but ſand can be met with, thoſe banks ſhould be large, and the ſlope very broad and extended; and if hay-ſeed will not grow on them, let ſea-weeds be planted. Theſe, with ſticking furze, ſtraw, or loppings of trees, will help to keep the banks together."

"It ſometimes happens, that the ſea flows in through a narrow gut or paſſage, by which the inland waters are diſcharged, and then extends itſelf, and covers a great deal of ground. When this happens, if the inland waters cannot be diverted into another courſe, ſince a paſſage muſt be left for their diſcharge, let a ſtrong ſluice be fixed in the loweſt part of the channel, with large piers of ſtone running out for it's ſupport, and a ſtrong foundation of wood or broad ſtones, for the water to run over. When this is done, let banks of ſand, or any other ſoil near at hand, be made in the manner before mentioned, on each ſide of the ſluice."

"The reaſon why it is adviſed, in places where a ſluice is to be made, to begin the work by this, rather than by the banks, is, that while the tides have liberty to flow in and out at a great breadth, the ſluice may be made in any part of the channel without being much incommoded by the tide; whereas if it be deferred till the banks on each ſide are made, the force of the tide when confined to a narrow paſſage, will tear up all before it, and render the building of the ſluice impracticable: and upon the ſame account, the banks ſhould be begun at the loweſt part of the channel, and from thence carried on to the upper grounds."

"If, by any accident, the waters ſhould ſwell ſo high as to overflow and tear the banks, farther miſchief may be prevented by fixing, with all expedition, a ſail cloth, or ſheet of linen at the bottom of the bank, where the flood breaks in; for if this be done in time, the water will flow over the linen without waſhing away the bank."

"In every improvement, the expence ſhould be particularly conſidered. That of making banks in this method is very ſmall. In low grounds, the ſoil is ſoft and dug with eaſe; and all the work may be done with the ſpade and ſhovel, without pick-axes, which muſt be uſed in up land ground; and the materials are on the ſpot. All the charge will often be more than repaid by the firſt year's improved crop of graſs and the ſafety of the meadows. The produce of ſucceeding years will amount much higher, and the huſbandman will be out of all danger for the future of having his lands overflowed and ſpoiled. Farmers have frequently ſuſtained more damage from the hay deſtroyed in one ſeaſon by floods, than the value of what it would have coſt them to incloſe and bank their meadows, and free them from all hazards."

When the cauſe of a bog proceeds from a neighbouring lake or river, which, without overflowing the parting ground, oozes through it's ſpungy ſubſtance; the only remedy is, to ſtop that ſubterraneous paſſage, by digging a ditch down to the very bottom of the ſand, and caſing it's inſide, or rather filling it entirely, with clay, which may generally be found in the bog itſelf: nor can there be a better foundation than this, for banks to guard againſt inundations.

ARTI-

Moors
Bogs

ARTICLE III.

Of the Improvement of Moors and Boggy Land.

WE often ſee new meadows ariſe from boggy grounds dried up. This happens ſooneſt when the moſſy ſubſtance has laid a foundation; for this, in proceſs of time, changes into a very porous mould, till almoſt the whole bog is filled with it. After that, the ruſh ſtrikes root, and, along with the cotton-graſſes, conſtitutes a turf, raiſed in ſuch manner, that, being enriched with fine earth brought from higher grounds, by rain, or other cauſes, the roots get continually higher, and thus lay a firm foundation for other plants, till the whole bog is changed into a fine meadow; eſpecially if the water happens to work itſelf a new paſſage [a]. Theſe changes, indicated by nature herſelf, point out the moſt rational means of improving ſuch grounds.

I ſhall begin with thoſe which are commonly diſtinguiſhed by the appellation of *Moors*. The firſt thing to be done to theſe, is to divide them into proper incloſures; not only to ſecure their future produce, but alſo to be a means of procuring rich earth to cover the otherwiſe inſipid uſeleſs mould on their ſurface, and give root to the plants which may afterwards be cultivated in them. Then, as the natural produce of this earth is of no value, it's ſurface ſhould be pared off, in order to be burnt. But as this ſubject, of burning earth, will be fully treated of in the next chapter, I ſhall only obſerve here, that the huſbandman ſhould be very careful not to make the clods too

[a] J. J. BIBERG's *Oeconomy of Nature, in* Stillingfleet's *Miſcellaneous Tracts. p.* 44.

dry, or light his fires in too dry a ſeaſon, leſt they ſhould extend farther and deeper than was intended.

If the depth of the *mooriſh* earth be not very conſiderable, the ſurrounding ditches, which make the incloſure, will afford a rich ſtrong ſoil, which ſhould be ſpread about three or four inches thick all over the ſurface. When the clods are burnt, their aſhes ſhould be mixed with this new ſoil. If no proper earth can be got from the ditches, ſand or gravel may be uſed with ſucceſs, as was practiſed by the ancients [b]. Gravel is ſingularly beneficial to ſuch lands, as will be more particularly ſhewn in the improvement of *Bogs*.

The Berne Society, who recommend this method of improvement as founded on repeated experience, very properly obſerve [c], that the good effects of the ſand and gravel will be conſiderably increaſed by a moderate mixture of dung, and that, eſpecially if the ground be intended for plowing, this covering ſhould be at leaſt a hand's breadth in thickneſs. Dung alone would undoubtedly be extremely efficacious on all ſuch ſoils, in which it is remarked to be of longer ſervice than in any other; but the farmer can ſeldom ſpare a ſufficient quantity of it to go far enough un-mixed, nor indeed for mixing. In this caſe, other ingredients muſt be recurred to; though the ſand, or gravel, will generally do great things without any mixture. Well preſerved aſhes will be of excellent ſervice, and ſo will the rubbiſh of old buildings, or any other ſimiliar ſubſtance, when mixed with the ſand or gravel, even of the coarſer kind, and incorporated with this naturally rich earth, which, were it's real value known, and the proper method of treating it rightly underſtood, might claim a

[b] VIRG. *Georg.* I. 110 [c] *Tom.* II. *Part.* 2. *p.* 290.

pre-

preference before any other ſoil. Loam is ſtill better than either ſand or gravel. This ſhould be brought on before the fires are lighted to burn the ſurface of the moſs, and ſhould remain in heaps till it can be equally mixed with the aſhes. Lime, where it can be had, will alſo contribute to the meliorating of moſſy grounds. —The mooriſh earth thus covered, is fitted for various kinds of crops, of which, together with thoſe of improved bogs, I ſhall ſoon have occaſion to take farther notice.

Mr. King, who obſerved [d] that the places in bogs in Ireland, where a little earth had chanced to fall as the peaſants were carrying it to mend the ways a-croſs them, became a green ſod, covered with a fine ſcutch graſs, does not doubt but that the ſame expence as ſands or gravels land, would bring a dried bog even to be arable; and as to the common opinion that gravelling is bad for graſs, the contrary, he ſays, is apparent; eſpecially in bogs. —Another method of reducing barren boggy land, in Ireland, is by laying upon it a little dung or ſtraw, and covering this with ſhells [h].

A ſtrong proof of the propriety of covering moſs with earth, reſults from a fact which happened to Mr. Græme, near Stirling [i]. Two years after this gentleman had earthed his moſs, which he had not yet ſowed, it was as full of natural white clover, and other graſs, as any field generally is in twice that time.

In the province of Groninguen, they pare off the upper ſurface of the ſoil, which is a light looſe earth, and lay it by till they have dug out the peat underneath, when they mix it with the ſand which lies under the peat, and ſow it with rye and

d *Philoſoph. Tranſ. No.* 170. h MORTIMER, *Vol.* I. *p.* 107
i MAXWELL's *Collection, p.* 62.

hay-ſeed the firſt year; after which they let it run to graſs, and have amazingly fine crops [k]. In Sweden, a drained bog was remarkably improved by a peaſant who burnt upon it a parcel of uſeleſs wood and lime-ſtones; and another converted his drained bog into a fine meadow, by covering it with lime and tanner's bark [l].

Mr. Eliot, after draining the ſwamp before mentioned [m], ſowed it with graſs-ſeed, ſuch as red clover, ſpear graſs, fowl-meadow graſs, and herd graſs *; none of which came up ſo well as the red clover, which he found to be the boldeſt and moſt hardy [n]. Though this came up well, yet, where the ſward was ſtrong, what with the toughneſs of the ground and the over-topping growth of the wild natural graſs, it made but ſlow progreſs till the fall of the year, and then it mended conſiderably. The other ſorts of graſs came up but poorly, the land being, as M. Eliot judges, too new and tough for them. In September, he plowed up a piece of this ground, where he had not ſowed any graſs. It plowed very tough, and the cattle mired in ſome places; but he kept them as much as poſſible upon the graſs; notwithſtanding which there was a neceſſity of leaving many baulks. About a month after, he ordered theſe baulks, to be hoed up, and was agreeably ſurpriſed to find how eaſily this was done. He found the meadow rotted and mellowed more in one month in the fall, than it had been in the whole ſummer; but thinks the plowing would have been performed with much greater eaſe, if it had been deferred till a month later. In July, he ſowed a little piece with turnips, which came up, but did

[k] *Memoires de la Societè de Berne, Tom.* II. *Part* 2. *p.* 292.
[l] *Ibid. p.* 293. [m] *p.* 137.
* Theſe two laſt ſorts, which are not known in this country, will be particularly deſcribed when we come to treat of *Paſtures*.
[n] *Eſſay* I. *on Field-Huſbandry, p.* 8.

not

not grow well till the ground began to rot in the fall of the year, when they throve perfectly, and were good and ſweet, inſtead of being rank, as he expected.

This gentleman found by experience, that ſuch drained land muſt have one ſummer to ferment and rot, ſo as to become proper ſoil, before it will be fit for grain or every ſort of graſs. "If, ſays "he [o], I ſowed red clover inſtead of the other "ſorts of graſs, I had ſaved five pounds in ſeed. "Clover out-did my expectation, and the other "ſorts fell ſhort of it. If others ſave where I loſt, "and mend wherein I was miſtaken, it anſwers "my deſign in writing."

"By a little experience which we have had of "theſe drained lands, we find they will produce "Indian corn, ſixty or ſeventy buſhels to an acre, "and flax. If life and health be continued, I "deſign to try liquorice-roots, barley, Cape-Bre-"ton wheat, cotton, indigo ſeed, wood for dying, "and the water melon. But what I have princi-"cipally in view is Hemp. New-England doth "not, I ſuppoſe, expend leſs than ſeveral hundred "thouſand pounds worth of foreign hemp yearly. "If we can raiſe more than to ſupply our own "occaſions, we may ſend it home. — It is not a "meer conjecture [p], that the drained lands will "produce hemp. I am informed by my worthy "friend Benjamin Franklin, Eſq; of Philadelphia, "that they raiſe hemp there upon their drained "lands.

"Hemp requires ſuch very ſtrong land to produce "it, that it would conſume all our dung to raiſe it "in any great quantities; ſo that we ſhould not be "able to raiſe bread-corn: therefore, how inviting "ſoever the trade is, and how great ſoever the

[o] *Ibid. p.* 13. [p] *Ibid. p.* 14.

en-

"encouragements have been, both from home "and by our own government, we have not as "yet engaged in that affair. We have now a pro- "miſing proſpect of ſucceſs in theſe drained lands: "what may be the iſſue, time and experience "muſt determine. — A meadow of drained land, "which could be laid under water, and this drawn "off at pleaſure, would probably be of great "value. I have heard that a man in the Jerſies "hath ſuch a meadow, which though only half an "acre in extent, yields him as much hemp yearly, "as ſells for fifty pounds, York money: but this "ſeems incredible."

Whatever advantages are reaped from hemp, may alſo be received from flax, if rightly managed, upon moſſy grounds. Some improvers in Scotland have already tried it with ſucceſs, and though, a new attempt, doubt not it's anſwering well in that kind of ſoil [q]. The moſt approved method of cultivating and dreſſing each of theſe ſingularly beneficial plants, will be given when we come to treat expreſsly of them.

Mr. Eliot continues [r]: "It is common in ſwamps to find the moſs two or three feet deep. At firſt, I was perplexed how to get rid of it, and ſome- what doubtful whether the land would be worth any thing if this ſurface was removed. When the water was drawn off by ditches, the moſs grew ſo dry, that in a hot ſummer ſeaſon, it would burn quite down to the ground. To burn this, or any other traſh you would conſume upon land, ſet fire to it when the weather is clear, the ſun hot, and a ſtrong ſoutherly wind blows, which makes fire rage more fiercely, and do much more execution, than a northerly or weſterly wind. In a northerly wind the air is thin and light, ſo that the fire is not

[q] MAXWELL, *p.* 63. [r] *Eſſay* III. *p.* 23.

Moors & Bogs

ſtrongly compreſſed: the moiſt heavy ſouth wind prevents the diſſipation of the fire, and renders it more compact. Thus we ſee a ſmith ſwab and wet his coals, by which means the heat is greatly increaſed. — Whether this reaſoning be juſt or not, the fact is certain, and that is the chief concern of the farmer.

"Deep ſwamps are preferable to thoſe which are ſhallow: for experience ſhews, that a deep ſoil bears extreme drought better than any other land, in the hot ſeaſon. The cold drought in the ſpring will hurt ſuch land, ſo that the firſt crop of graſs will not be very great; but the ſecond crop will be extraordinary good.

"The red clover in my drained land abovementioned, looked in the cold drought at the latter end of the ſpring, as if it would not come to any thing: but it recovered a good colour, and grew up well, when hot weather came on, though the drought continued. This is ſuch an advantage as will always recommend a ſoil eight or ten feet deep.

"Our ditching and draining dry only the top of the ground, not more than three feet deep in the hot and dry ſeaſon. I ſuppoſe that the moiſture from the mud and water underneath is drawn up by the force of the ſun, ſo that the roots of the graſs are furniſhed with ſufficient moiſture to bring forward the vaſt burthen they frequently bear. But this is not to be expected till the land be concocted, changed, and altered by the ſun and air: for at firſt, ſoon after it is drained, it is pinched with the drought more than any other land.

"Thoſe ſwamps which are thick overgrown with moſs, prove as good as any other drained land, when they are ſo far dried by draining, that the moſs will rot, or burn off. I mention this, becauſe

becauſe it is beſt that the farmer work as free from diſcouragement as poſſible.

" Our drained land, though in all other reſpects well adapted for producing Indian corn, is of ſo looſe a texture that the plants become an eaſy prey to crows and other birds, which if not prevented, will pull up a great part of them, and deſtroy the crop. To guard againſt this great diſcouragement in all ſuch land, " Take the roots of " *ſwamp hellebore* (known in different places by the " ſeveral names of *ſkunk cabbage*, *tickle weed*, *bear* " *root*), and boil them in ſo much water as to " keep them covered an inch deep: by two hours " boiling, the liquor will be of ſufficient ſtrength: " ſtrain it off; put your corn into it while the " liquor is warm, and let it ſteep twenty hours. " It will then be fit for planting."

" This is found to be an effectual ſecurity. The Rev^d. Mr. Todd informs me, that after meeting with much trouble and loſs, by having his corn repeatedly pulled up, he planted his ground with corn ſteeped in this liquor; but not having enough of that, he ordered the planting to be finiſhed with un-ſteeped corn. The event was, that the birds pulled up but two or three hills of the ſoaked corn, but left not one in ten of thoſe which were planted with un-ſoaked corn. He planted anew, with ſteeped corn, the hills where the plants had been thus pulled up, except a few of them in the middle of the field, which were planted a ſecond time with unſteeped corn, upon a ſuppoſition that the birds would not find them out: but the reſult was as before: all the un-ſoaked was pulled up, and the hills planted with the ſteeped corn were ſpared.

" Upon the whole, " ſays Mr. Todd, in the concluſion of his letter to his brother Clergyman Mr. Eliot, " I think this experiment a full proof

" that

"that corn ſo prepared when planted, is ſecure "from the birds *; the knowledge of which may "be of great ſervice to huſbandmen, as the pre- "paration is cheap and eaſy, and our ſwamps "ſeem to be by far the beſt land we have for "Indian corn. My little ſwamp, this year, yielded "after the rate of above ninety buſhels to the "acre, and was eaſier and cheaper tilled than the "ſame quantity of upland."

The moſt laſting and moſt perfect improvement of Bogs is effected by paring off their whole ſurface, and burning it, like that of mooriſh ground. To this end, they ſhould be levelled; and whatever earth remains unemployed in filling up hollows, ſhould be burnt, with that taken out of the ditches, unleſs the latter has been already carried off for fuel. The greater the quantity of aſhes is, the greater will be the improvement of the ſoil itſelf, and the more will the earth brought upon it be benefited. The fire on the ſurface of the moſs, exhales much of the bituminous acid of this ſoil, and the fixed alkaline ſalt conſtantly found in ſome proportion in the aſhes, corrects or neutralizes it, ſo that no inconvenience ariſes from it afterwards, if the ground be kept dry as it ought to be. The fire ſhould not be fierce, but rather ſmothered.

When the bog is pared, and the clods are collected to dry, the farmer muſt prepare earth to cover the ſurface. Marle, which is often found under bogs, preſents the beſt covering that can be deſired. If a clay lies under the bog, it muſt be prepared before it is ſpread, as already directed in the making of compoſts, excepting only that the

* It may be worth the farmer's while to try this well atteſted receipt upon other ſorts of grain; ſteeping them, perhaps, a ſhorter time, in proportion to their ſmaller ſize.

quantity

quantity of other ſubſtances mixed with it, ſuch as dung, &c. need not be ſo great in this caſe, becauſe the aſhes, and the bog itſelf, will aſſiſt much in opening the body of the clay. If a loamy earth be near at hand, it will perhaps be leſs expenſive to the farmer to bring ſuch earth to cover the bog, than it will be to dig and prepare the clay. Of whatever kind the earth be which is laid upon the bog, the quantity ſhould always be ſufficient to cover it's whole ſurface four, five or ſix inches deep, according to the ſtiffneſs of the ſoil ſo brought. Thus four inches of clay, when mixed with the aſhes and a due quantity of the earth of the bog itſelf, will give a depth of covering mould equal to what ſix inches of loam will do, when likewiſe mixed in proportion to it's quality. If the bog be intended for arable land, the depth of the covering earth ſhould be greater; becauſe all kinds of grain, eſpecially wheat, require at leaſt a foot depth of good mould to extend their roots in, before they come to any cold or tenacious ſubſtance like peat or clay, as will be demonſtrated in the article of *plowing*. In this caſe, the covering of clay or marle ſhould be ſix or ſeven inches thick, and that of loam eight or nine inches.

As ſoon as the ſurface is burnt, it's aſhes ſhould be ſpread and mixed with the additional covering, which will then be fit for the farmer's purpoſe, whether for corn or graſs. If the extent of the bog intended to be improved be conſiderable, it would be adviſeable, by means of a ſluice, to fill the ditches contiguous to the ſpot which is to be covered, and to bring the earth in barges, or flat bottomed boats, kept on purpoſe to tranſport the neceſſary manures and the produce of the ground. By this means a ſaving will be made of the ſurface otherwiſe neceſſary for cart ways. Beſides, this ſoil, eſpecially, when newly drained, does not

well

well bear heavy carriages: a circumſtance which renders it needleſs to obſerve, that broad wheels are always the moſt proper, where any muſt be uſed upon ſuch land.

The bog being covered with a due proportion of earth, the huſbandman muſt next determine to what laſting purpoſe he can beſt apply it. The too great moiſture of theſe ſoils, which always lie flat, renders them unfit for continued tillage; and their mould becomes ſo looſe, by frequent plowing, that it does not afford ſufficient ſtability to the roots of corn. For this reaſon, barley, oats and rye, do better here than wheat, which requires a firmer footing: but neither of them ſhould ever be ſowed thick; becauſe the fruitfulneſs of the ſoil will always make up in the ſize of the plants, what ſome might think wanting in their number. The moſt beneficial method of employing this ſort of land is, undoubtedly, by converting it into meadow; becauſe, when thus prepared, and not injudiciouſly exhauſted by crops of corn, it will yield great quantities of excellent graſs. It is, however, uſual to begin with ſowing ſome kind of grain on this prepared ſurface, to indemnify the farmer by the plentiful crop which it generally yields; ſuch, indeed, as ſometimes defrays at once the whole expence of the improvement. Perhaps the moſt profitable method may be, to ſow it in the autumn with rape, the leaves of which, ſhading the ſurface in hot weather, and rotting in the winter, contribute greatly to mellow the earth: the ſtrong roots of this plant open the ſoil; it's aſhes enrich it, when burnt, and it's ſeed brings a great return when ſold for making oil. One or two plowings will then prepare it for a crop of wheat. After this is taken off, and the ſtubble turned down or burnt, white clover and graſs ſeed from upland paſtures ſhould be ſowed, and the ground

ſhould

ſhould then be laid down for a laſting meadow: or, if turnips are ſowed, or cabbages planted, in the autumn, theſe, in the ſpring, may be ſucceeded by barley, with which the graſs ſeeds may be ſowed.

The ſhorteſt work of all for the improvement of moſs, if the ground be deſigned only for graſs, and it's ſituation be ſuch as admits of it, is this: [a] Firſt drain the moſs, and if there be heath upon it, burn that off, and make the ſurface even. Then make a dam at the loweſt part, and a ſluice, and work the water upon it through the winter. The mud which comes with the land-flood will bring a fine ſward upon it in two or three years, and be afterwards a yearly manure; ſo that it will bear annual cutting, and, beſides, be good paſture for cattle, after the ſward is become ſtrong enough to bear them.

Mr. Græme found [b] that the improvement of moſs may be endangered by draining it too much; for his crops were beſt where the ſurface of the water in the ſurrounding ditches was not above three feet lower than the level of the moſs. It will, undoubtedly, be a vaſt advantage to an improved moſs, if the farmer is able to flood it at proper times, by means of a ſluice in the loweſt part of the ſurrounding ditch, as mentioned before. This will greatly promote the growth of plants; but ſhould be uſed with the caution of not letting the water remain too long at a time upon the ground, becauſe, though there will be no danger of it's re-converting the ſoil into a bog ſo long as there are channels to carry it off, it will be apt to chill, and thereby hurt the plants.

When, either through neceſſity, for want of other arable land, or out of choice, the farmer intends to continue plowing his improved bog, the ſurface

[a] MAXWELL, *p.* 43. [b] *Idem. p.* 58.

muſt

muſt be raiſed in ridges (the manner of doing which will be deſcribed in the general directions for plowing), and the farther management of it may be like that of moſt other plowed ground.

If a ſoil of this kind happens to be ſituated near a town, a greater profit will accrue from planting it with garden ſtuff, than from any ſort of grain. Beans, peas, cabbages, potatoes, turnips, carrots, &c. thrive exceedingly well in ſuch earth as this, as the marquis of Turbilly experienced to his entire ſatisfaction.

"I received ſays he [a], from *Straſburg*, in the year 1755, ſome ſeed of the large hard cabbage, which was immediately ſowed in my garden, from whence it was afterwards tranſplanted into a bog, which I had drained and cleared. This ſpot contains about an acre of ground, and forms a kind of iſland in my river. It had been pared and burnt; but never received any other manure than the aſhes produced by that burning; no ſort of dung having ever been laid upon it. The whole of it was planted with this kind of cabbage, excepting only a corner, where a few carrots, parſnips, and beet-roots, all of which grew to a prodigious ſize and proved exceeding good, were ſet out of curioſity. Theſe cabbages throve wonderfully, ſeveral of them weighing forty pounds a piece, were well-taſted, and very wholeſome, though ſome of the country people ſeemed poſitive that they and the other pot-herbs would be hurtful, unhealthy food, as, ſaid they, all plants are during the firſt year of their growth in new-drained bogs.

"Theſe people pretended to have experienced this in other places: but not finding it ſo here, I aſcribed the effect they talked of to ſome pernicious quality in the ſoil; for I was very ſure

[a] *Memoire ſur les Défrichemens, p.* 167.

that the violent operation of the fire which mine had undergone, had not left any bad property in the earth. During the reſt of the ſummer, and the autumn, ſome of the neighbouring peaſants, whom I hired for the purpoſe, carried this great quantity of cabbages to the markets of three different towns, about ſix miles off: there they ſold them; and the accounts which they gave me of their produce amounted in all to eight hundred and fifty livers (37 *l.* 3 *s.* 9 *d.*). The wages of theſe men, and the expence of carriage, amounted to about half this ſum; which being deducted, my acre of bog produced clear four hundred and twenty-five livres (18 *l.* 12 *s.* 10 *d.* halfpenny), with which I was the better ſatisfied, as the cultivating of it had coſt me but little. The ſoil, being light, was eaſily turned up, though fat; and I had drained off the water without difficulty, by means of a ſlope which happened to be properly ſituated. I never had been offered above a crown a year for this piece of marſhy land, which was quite a ſhaking bog, and often overflowed. When drained, it's ſurface ſunk a foot lower than before. So great a produce, from ſo ſmall a ſpot of ground, of which no one knew the goodneſs, ſhews what vaſt riches are hid beneath the ſeveral bogs in this kingdom. They are not, however, all like this, which chanced to be a very fertile ſoil. I could wiſh to be maſter of ſeveral others like it. It has ſince been ſowed with hemp, peas, and ſeveral other plants, which have done very well, though no one of it's crops has produced ſo much money as this firſt; which ſhews the difficulty of ſetting a juſt value upon land. All the other bogs which I have drained and cleared in different ways, have anſwered, in general: but no one ever yielded, in proportion, any thing like this ſpot."

That

That benefits, hitherto unexpected by the generality of husbandmen, may, with a little care and proper management, arise from every kind of bog, not excepting even that species which is commonly reckoned the very worst of all, is apparent from the following letter, with which the Dublin Society have favoured the public.

"Among the several kinds of bogs, the *red* are deservedly esteemed the worst. Black bogs yield some kind of pasture, of a finer or a coarser grass, according to the nature of the bog: They are besides more easily reclaimable, and if the upper surface be skimmed off and the sods burnt, they afford for their own manure a large quantity of red heavy ashes, strongly impregnated with salts; whereas the red bog, which has none of these good qualities, has a spungy, light, fungous, variegated surface, bears no grass, and when burnt, yields very little ashes, and even those white, flaky, light and insipid. This is so well known, that these bogs are never charged with rent in Ireland, but are thrown into the survey of farms as unprofitable lands. I have indeed reclaimed some of this kind of bog, in a different manner, and for other purposes than hops, and therefore cannot join in calling them unprofitable: but since they are generally so esteemed, and accordingly neglected, it will be of equal service to my country, to promote the culture of them under hops, as if they were really so. — There are in the execution of any new improvement many little circumstances, which alleviate the labour and lessen the expence; and though they may appear trifling upon paper, they are however of considerable importance in practice: these I shall therefore take leave to observe as I go on, being less

c *Dublin Society's Observations, No.* 19.

concerned for elegance and neatneſs in a performance of this kind, than for the eaſe and advantage of the huſbandman.

"Round the ſpot intended for the hop-yard, dig a trench ſeven or eight feet wide to drain off the water; give it all the depth the fall of the bog will bear, and if you cut it into the gravel 'tis the better: make your trenches ſtrait, and every where of an equal breadth; to which end lay them out, and mark them by the line. The ſcore or mark is made in upland with the ſpade; but in bogs, a hay-knife is much better. One man will cut faſter with this inſtrument, than five men in the common way.

"When that is done, take off the firſt or upper ſods of your intended trench with the ſpade; but beware of cutting your ſods too large: they are then inconvenient for carriage, and increaſe the labour of removing them. Make them of ſuch ſize that they may be eaſily turned up, and thrown with pitch-forks on a wheel-barrow: you may then, at a ſmall expence, convey them where they may be uſeful. The proper uſe of them is to fill the adjacent bog-holes, and level the uneven places of your bog. However, it will be neceſſary to reſerve a few of them for facing your ditch, in the ſame way as you do upland ditches.

"When the firſt ſod is pared off, proceed to dig your trench: the ſoil thrown up will be as good turf as any other, and defray the expence of trenching; and this I deſire may be underſtood as a general direction, and applied wherever a trench or hole of any ſize is to be cut out in a bog. By this means, the charge of digging is made up to the farmer in good turf, and the labour pays itſelf.

"In cutting your trench, be careful to leave a gun on each ſide of your plot: this is a piece of bog uncut, deſigned as a paſſage in and out, with

a

a channel for the water bored in it: it muſt be nine or ten feet wide, and the arched channel under it of ſufficient height and breadth to let the water through. In ſhort, a gun is a natural bridge, and muſt have the ſame qualities, ſtrengh in the arch to afford a ſafe paſſage over, and wideneſs equal to the diſcharge of water. Two men with ſpades or ſhovels, thruſting from each ſide, till their tools meet, will make one in a little time.

"There is another circumſtance to be obſerved in the making of your trench: at the loweſt part of it, where the water is diſcharged, leave a bank of two feet high uncut, to keep it to that height in the whole ſurrrounding drain. By this means you have a reſervoir at hand for the uſe of your hop-yard, which, whenever a dry ſummer happens, will require to be well watered; and beſides, a ready and cheap manure from the ſludge or mud, which will lodge at the bottom of your trench, when the current is checked by this little bank. Some indeed may fear that the incloſed ground may ſuffer by this method, and be kept too moiſt by the water about it; but this I am by long experience ſatisfied, is a groundleſs apprehenſion. The flowing water, with a fair vent before it, has little lateral preſſure, but directs it's way where it has the freeſt paſſage. I have made large drains in a bog, and kept them full of water, within a foot of the brim, and found no inconvenience attending it.

"When your ſurrounding ditch is finiſhed, at four feet diſtance from the inner edge of it, and exactly parallel, draw another inſide trench of two feet wide and two feet deep: let it be drawn like the former round the ground, and by the line; then fill it up with proper ſoil, and plant ſallies in it, or any other aquaticks fit for poles. They will thrive here exceedingly, and with proper care, in

ſix years time be ready for the uſe of the hop-yard. The earth about them is kept moiſt by the bog about it, and their roots are preſerved from froſts and winds by the diſtance of their ſtand from the edge of the main drain; ſo that nothing can prevent their growth; to forward which, as much as poſſible, two cautions ſhould be uſed: the firſt, to ſtrip off the ſide ſhoots when tender, to prevent their running out into ſtrong branches, which impair the body of the tree; the ſecond, to throw up the mud out of your trench upon their roots, and that way to ſupply them with freſh nouriſhment. This ſhould be done when the ſallies are two years old: at that time, and in the heat of ſummer, cut the little bank which keeps up the water in your trench, and leave the drain entirely dry: the mud at bottom will grow ſtiff and be eaſily thrown up, and your trees manured at very little charge.

"When your bog is thus prepared and incloſed, ſtretch a line parallel to any one ſide of the incloſure, at twenty or twenty-five feet diſtance from the ſally trench. To this line tie rags or feathers nine feet aſunder from each other; and when your line is ſtretched upon the ground, at every mark or feather drive a ſharp ſtick into the bog to determine the centers of your hop-hills. When the firſt row is finiſhed, remove the line to nine feet diſtance, and mark out a ſecond; from that proceed to a third row, and ſo on, until you have finiſhed the whole plot.

"The ground being thus ſet-out, and the centers of your hop-hills regularly diſpoſed at nine feet diſtance from each other, your firſt work will be to dig a hole at every center, three feet wide, and three feet deep; to lay the upper ſods of it in the hollows of your bog, and to make turf of the remaining ſoil. If you proceed in your work

work that ſummer, your turf muſt be wheeled off immediately, to be ſpread and made upon other ground; otherwiſe it would prevent the paſſage of the tumbrils, which you have occaſion for in your next buſineſs. This is, to fill up your holes with proper earths or compoſts, in order to receive the hop-ſets, which are to be planted here, and afterwards managed in the ſame method as in other places. To do this, it is obvious that much earth will be wanted in a plantation of any ſize; and how to provide himſelf with a ſufficient quantity at a cheap rate, is of great importance to the farmer. My method is as follows.

"In the upland neareſt to the bog, I take off the ſward of a ſmall plot with the hoe or winged plough: I burn it, and by thorough plowing mix the aſhes with the mould. To theſe I add a little lime, rotten dung, or rich garden mould, and throw the whole together into heaps where it heats and rots, and in a little time affords the richeſt compoſt, and the beſt ſoil for hops. I have made artificial earths in this manner, not only for the preſent purpoſe, but alſo in other improvements, and found them, upon trial, a great deal leſs expenſive than it appears at the firſt view. The carriage of them to the bog is the heavieſt article in the expence; though this is much alleviated by the breadth of the allies, and the method of planting the hops in holes. As the tough ſurface of the bog is no where broken, but in the very ſpots where the hops are planted, it affords a ſafe paſſage for cattle: and as the walks are ſix feet wide, the hills being but three feet over, and the centers nine feet diſtant, you may make uſe of cars and tumbrils, a cheap and commodious carriage.

"I own that, notwithſtanding theſe precautions, this improvement is expenſive: but raiſing hops in any ground is ſo, and, I am ſure, greater

in the moſt favourable upland ſituations, than in a bog. A very little arithmetic will ſhew, that ditching and incloſing, which is no expence in bog, the turf made at the ſame time being equal to the charge; that plowing, harrowing, fallowing, and digging, which in my method are entirely ſaved, with the additional articles of dunging, hoeing, and paring the allies in uplands, are more than equivalent for all the labour and expence attendant on bog-hops; and from fifteen years experience, I can venture to affirm, that the produce from the latter is as great in quantity, and, in quality, as good. Many reaſons might be given why it ſhould be ſo; ſome of which I beg leave to mention: they may be neceſſary to remove the prejudices which generally attend new projects, and to make this improvement as common as, I am ſure, it will be beneficial.

"Were it peculiar to my method, I ſhould reckon as the firſt advantage of it, that the hills ſtand at nine feet diſtance: but as this may be imitated in uplands, I ſhall only ſay in general, that nothing is more prejudicial to hops than cloſe planting.

"The care taken in uplands to hoe and pare the allies, ſufficiently ſhews that it is eſteemed a diſadvantage to have any quantity of graſs growing among hops: red bogs are, by their nature, free from this inconvenience, and, at leaſt for many years, till the ſurface is intirely altered, throw up none, or very little. How far planters are right in their opinion, that a coat of graſs impairs the action of the ſun upon the fruit, I ſhall not here examine; but while that opinion holds, it will ever be a reaſon in favour of *red* bogs.

"Watering hop-grounds in dry ſeaſons, though, from the great expence attending it, too much neglected, is certainly of great benefit to the crop. This may be done in bogs, with great convenicncy

Moors & Bogs

ency and little charge. The ſurrounding drain is a conſtant reſervoir where the planter may be readily ſupplied; and whoever underſtands the culture and growth of hops, will reckon this no ſmall encouragement.

"It is agreed among hop-planters, that low grounds have great advantages: they are little expoſed to droughts, and ſheltered by their ſituation from deſtructive ſtorms. Bogs enjoy thoſe in common with the reſt; beſides, as long experience has informed me, ſome peculiar to themſelves: they do not ſuffer ſo much as other flats, by the rains of a wet ſeaſon, or the mildews of a dry one. Whether their ſpungineſs affords a paſſage to the waters, which lodge in other grounds, and their conſtant moiſture prevents the bad effects of too much heat, I ſhall not now examine; but the fact itſelf is certain: they are free from the inconveniencies above-mentioned, and, what is more remarkable, from thoſe ſwarms of inſects which too often infeſt our upland hops.

"I muſt add, that, in this way of planting, the top roots have liberty to ſhoot as far as nature deſigned they ſhould: they have three feet of the richeſt ſoil to go through before they run into the bog, and even there, when once it is well drained, they will meet with better juices than in a cold ſtiff clay, or a ſharp four gravel, which are the upland bottoms.

"The poles will ſtand as firm in theſe bogs, as in upland ground. The earth laid into the holes being preſſed together and confined by the tough ſtringy ſubſtance of the bog, will ſupport them ſufficiently, without ſinking them any deeper than improvers direct in other hop-yards."

The ſucceſs of this experiment in what is commonly, but, it is plain from hence, erroneouſly deemed an abſolutely barren ſoil, ſhews what may be done with lands known to be leſs ungrateful.

CHAP.

CHAP. II.

Of the breaking up and improving of UNCULTIVATED LANDS.

BY lands which ſtill remain in an uncultivated ſtate, is meant, ſuch as are covered with wood, ſuch ſpots as are not ſufficiently drained to admit the plough, and commons, or other grounds, which produce nothing but heath, broom, furze, fern, &c.

SECT. I.

Of clearing and improving WOOD-LANDS.

IN ſome countries, ſuch, for inſtance, as moſt parts of America, where there are ſo much wood and unoccupied land, that neither is much valued, or bears a great price, people ſeldom take the trouble of cutting down the woods; but, when they want to convert a piece of wood-land into arable, they ſet fire to the coarſe graſs, dry leaves, and underwood, as ſoon as they are dry in the ſpring. This fire generally deſtroys the trees at the ſame time: for if it does not totally burn them, it at leaſt ſcorches them ſo that they die; and after this the peaſant rarely is at the pains of felling them, but lets them ſtand till they rot and drop of their own accord, which creates a great deal of extraordinary labour in the plowing or other improvement of the ground. But in places where timber is ſcarce, great care is taken to preſerve it; the ſtumps of trees are grubbed up, and a profit is found even in digging up their roots.

The

The Society eſtabliſhed at Berne, juſtly remarkable for the judgment and aſſiduity with which they devote themſelves to the advancement of the oeconomical intereſts of their country, have publiſhed[a] a very eaſy method of removing the inconveniencies which ariſe either from the trees themſelves, or from their roots, by means of two machines invented by Peter Sommer, a peaſant in the canton of Berne.

The former of theſe, for rooting up trees, was tried in the preſence of the chief magiſtrates of Berne and a great number of ſpectators, in December 1759, in a wood near that city, where it pulled up an oak three feet eight inches in diameter towards the bottom, with all it's roots, in eight minutes time, though the ground had been conſtantly frozen for near two months: and, lately, it was tried with ſimiliar ſucceſs by a committee of the London Society for the Encouragement of Arts, Manufactures, and Commerce.

The two beams *A* of which only one ſide is ſeen in *Fig.* 1. *Plate* III, are formed of ſtout planks of oak, each three inches thick at leaſt, and bored through with correſponding holes, as marked in the drawing, to receive iron pins, upon which the lever acts between the two beams, and which are ſhifted higher and higher as the trees is raiſed up. The diſtance between the two beams (where the lever works) is likewiſe three inches. Theſe beams are well ſecured at top and bottom, by two traverſe pieces which keep them at a proper diſtance from each other, and ſtrong iron hoops which bind them faſt.

The iron pins on which the lever reſts ſhould be an inch and a quarter, and the holes through which they go an inch and a half, in diameter.

[a] *Memoirs de la Societé de Berne, Tom.* I. *Part.* I. *p.* 175.

The

The poſition of theſe holes is ſufficiently indicated in the annexed drawing.

The foot of the beam is ſecured by ſtakes driven ſlanting into the earth.

The ram *B*, which is made of elm, or ſome other ſtrait grained wood, not apt to ſplit or bend, is capped with three ſtrong iron ſpikes, which take faſt hold of the tree. This ram is ſix or eight inches ſquare; and a ſlit is cut lengthwiſe through the middle of it, from it's loweſt and thickeſt end to the firſt of the two ferrules *a* and *b*, to allow room for the chain *C* to play round the pully *c*, which ſhould be four inches thick and nine inches in diameter.

The friction would probably be leſs, and conſequently the engine would be worked more eaſily and have greater force, if this pully *c* turned with it's axis in the ram, inſtead of turning upon it.

This ram, with the pully, is raiſed by the chain *C*, which ſhould be about ten feet long, with links four inches and three quarters in length, and half an inch thick. One end of this chain is faſtened to the top of the beam *A*, whilſt the other, paſſing through the diviſion in the lower part of the ram, goes round the pully *c*, and terminates with a link like *G*, *Fig.* 2, where the end of the hook appears inſerted in it.

This hook, *F*, diſtinctly delineated in *Fig.* 3, which (as well as *Fig.* 2,) is drawn upon a ſcale of twice the ſize of that of *Fig.* 1, ſhould be made entirely of tough iron, as ſhould alſo the handle *E*, and the arch *H*. This handle ſhould be two inches thick where it joins to the hook, from whence that thickneſs ſhould leſſen by degrees up to the arch, which need not be more than a quarter of an inch thick.

The lower part of the ram is kept tight to the beams by a ſtrong iron on each ſide, and two croſs bolts, as at *II*, by which means it is moved along the

the beams as the machine works; and at the upper end of the beams, the ram ſlides through an iron faſtened to them.

The lever *D*, ſtrengthened with two iron rings, has a deep groove at it's thickeſt end, to receive the handle *E*, to which it is faſtened by two pins, the outer of which is put through whatever hole of the arch beſt ſuits the working of the engine.

Five or ſix men work this inſtrument with great eaſe. Two or three of them, applied to the lever, raiſe the ram with a force ſufficient to root up a tree: a fourth ſhifts the pins on which the lever reſts; and two others, at a proper diſtance, hold a rope faſtened to the top of the tree to direct it's fall.

This machine cannot be placed perpendicularly, but muſt be inclined, becauſe the tree, when lifted up, raiſes the earth by it's ſpreading roots, for ſome feet around it.

The ingenuity of the Swiſs peaſant certainly deſerves great commendation. Examples are not wanting of different perſons who have invented even exactly ſimiliar things, without having had the leaſt correſpondence or communication. Each inventor is then juſtly entitled to the honour of the invention. It therefore is not by any means to leſſen the merit of Peter Sommer's that I obſerve, that Mr. Emerſon, in a machine which he calls a *lifting ſtock*, deſcribes what conſtitutes the chief excellency of this engine, the alternate ſupports of the lever [a].

The foundation of Mr. Sommer's other machine, *Fig.* 4, *Plate* III, for pulling up the ſtumps and roots of trees, is the two beams of the inſtrument we have been ſpeaking of. The ram is

[a] *Principles of Mechanicks*, *p.* 245. *Fig.* 295.

taken

taken off, and the planks *A* are ſet upright near the ſtump intended to be wrenched up. A chain, one end of which is faſtened to the top of the planks, goes round a pulley *b*, which turns in a block *C*; and it's other end is lifted up, as before, by a hook and the lever *D*. Another chain *c* is fixed to a ſtrong ring at the bottom of the block, and, by digging a paſſage for it, carried under a main root of the ſtump intended to be pulled up. The other end of this chain is then carried round, and hooked to another ring at the bottom of the block. The lever eaſily performs the reſt of the work.

A bare view of FIG. 5. PLATE III, is ſufficient to explain a very ſimple engine which Mr. Evelyn gives [b], for pulling up large roots.

The handle *A* turns the ſpindle of the pinion *B*, which has four or five teeth. Theſe teeth turn the larger wheel *C*, which moves the cylinder *D*, on which the rope *E* is rolled as the root is drawn up; one end of the rope being previouſly faſtened to the cylinder. The whole frame is let into a block of wood *F*, about four feet high and one in breadth; and the other end of the roller or cylinder is ſuſtained by a leſſer block of wood *G*. *H* is an iron plate which holds the wheel and pinion in the larger block. The cylinder, wheel, pinion, and handle of this machine ſhould be made of good tough iron. The cylinder may be about four inches in diameter, and fourteen or ſixteen inches in length. The reſt is obvious: though I apprehend an improvement might be made, by adding a catch, to ſecure either the handle or the cylinder, while the labourer (for one man will eaſily manage this engine) may be obliged to ſuſpend his work, in order to clear away any ob-

[b] *Sylva, p.* 24.

ſtacle

Fig. 1.

Fig. 4.

Fig. 5.

Fig. 2.

Fig. 3.

Fig. 9.

Fig. 8.

Fig. 6.

Fig. 7.

Scale of 6 Feet

J. Goldar sc.

p. 215

ſtacle that may have occurred. It would likewiſe certainly be right to place the wheels, and conſequently the handle, ſomewhat higher than is here directed, to ſave the very great fatigue of ſtooping down continually while this laſt is turned.

Where the roots are very large, and obſtinately tenacious, M. de Turbilly's advice [c], to blow them up with gun-powder, will be found very beneficial; eſpecially if neither of the abovementioned inſtruments can be had.

Where a place has been over-grown with wood, the earth is ſo thoroughly ſtirred by digging and pulling up the ſtumps and roots of the trees, that one plowing in autumn is generally ſufficient. The froſts in winter kill the weeds and break the clods; and after a ſecond plowing, in the ſpring, theſe lands may be ſown with expectation of an abundant crop: for the trees not having exhauſted the earth towards the ſurface, but having on the contrary manured it with their leaves, a conſiderable produce may be expected for many years.

M. Du Hamel mentions [d] a ſmall field, which had formerly been underwood, and being converted into arable ground, produced plentiful crops of wheat and oats for upwards of twenty years running, without being reſted. 'Tis true the ſoil was peculiarly proper for wheat, and would have been exhauſted much ſooner if it had been a poorer earth.

[c] *Memoire ſur les Défrichemens, p.* 9.
[d] *Culture des Terres, Tom.* I. *p.* 68.

SECT.

SECT. II.

Of draining and improving MARSHY LAND.

HAVING already treated of bogs, or ſuch ſpots as have on their ſurface mooriſh or peat earth; I ſhall here ſpeak only of draining and improving places which are covered with a natural ſoil, but are ſo marſhy that they cannot be turned either to arable or good paſture land, till they have been drained.

Where coarſe graſs is produced, the ground is evidently over-charged with moiſture [e], proceeding either from cold hungry ſprings, loaded with ſome mineral or acid, which want vent; or elſe from external floods, which, being confined by a ſtiff clay, impervious to water, remain upon it, and corrupt the natural nouriſhment proper for producing the ſweet and richer graſſes. When this laſt is the caſe, the remedy is eaſy, by making proper drains to carry off the ſuperfluous moiſture. But if the land be ſpouty or ſpewy, as it is commonly termed, and the moiſture ariſes from ſprings, a deep drain muſt be cut in the loweſt part, and ſmaller drains from that principal ditch to ſuch places as appear to be the heads of the ſprings, which will be known by their being wetter and looſer than other parts. The drains muſt be cut deep enough to reach the bed, whether gravel or ſand, through which the water flows; and upon the firſt touching of this, the water will be found to run off more freely, and in greater quantity.

The ſmaller drains, communicating with the main ditch, ſhould be left open for ſome time,

[e] MAXWELL, *p.* 9.

until

until the quantity of moiſture abate. After this, to make them covered drains, by which the ſurface is rendered level, and no part of it is loſt, they ſhould be filled up with ſmall ſtones to within about a foot and a half of the ſurface, and then covered with turf, the green ſide downward, or with heath, broom, ſtraw, or any other thing that can moſt conveniently be had, proper to keep the earth from falling in among the chinks of the ſtones, through which, if no ſuch accident happen, the water will paſs eaſily, the drains will prove effectual, and the plough, after the earth that was turned out is laid above all, will go freely over, without being oppoſed by the ſtones. A foot depth of mould over the drain will be ſufficient in paſture grounds; but this covering ſhould be at leaſt a foot and a half thick in plowed lands. Where ſtones are ſcarce, faggots made of the branches of any kind of trees are ſubſtituted in their ſtead: but they do not anſwer the purpoſe ſo well, becauſe they decay and rot, the earth falls in, and the drains are ſtopped: though it is highly proper, where theſe are uſed, to line the ſides of the drains with brick or ſtone, without mortar, to keep the earth from falling in there, and at the ſame time give free admittance to the water. It muſt be obſerved, that, where a great quantity of water is to be diſcharged, the main drain, into which the ſmaller drains are to empty themſelves, ſhould not by any means be filled up, even with ſtones, unleſs it be both very deep and very wide, and there be a great quantity of ſtones to throw into it, leſt it ſhould not be able to diſcharge all the water; in which caſe the whole work will prove worſe than uſeleſs; a remedy being very difficult on account of the ſtones.

The beſt time for covering theſe drains is about Michaelmas; becauſe, the earth is drieſt at that

ſeaſon, before the winter rains begin to fall. The digging of them is, indeed very laborious work, particularly in marſhes, the ſoil of which is always of a tough ſtrong quality. It therefore is of great importance, that every means be uſed to leſſen that fatiguing labour. The ſhovels and ſpades univerſally uſed are certainly too ſhort. Their length ſhould be ſuch as to give the labourer every advantage ariſing from his own ſtrength. In order to have this, he ſhouid ſtand as erect as poſſible: for otherwiſe, he has not only the weight of the earth on the ſpade or ſhovel to raiſe, but alſo that of his own body; whereas, if the ſhovel be of a due length, an eaſy ſhifting of the lowermoſt hand becomes a prop, or point, on which the weight at the end is raiſed, almoſt without bending the body.

Where the ground in which the ſprings are lies on a gentle declivity, Mr. Tull, very properly, adviſes plowing it nearly horizontally, by which means each furrow carries off the water which would otherwiſe ſink into the next ridge. If the clay underneath lie at ſo ſmall a depth that the plough can reach it, this will have a very good effect: and as the nearly horizontal direction of the furrow gives the water but a ſlow motion, it will not be ſo apt to waſh away the richer mould, as it would if the furrows were more perpendicular to the declivity. Theſe furrows ſhould, however, have ſlope enough to give the water a current ſufficient to prevent it's ſoaking into the ridge underneath.

If the ſprings riſe only at the bottom of a ſloping ground, one large drain, reaching the whole length of the declivity, and cut down to the bed of clay underneath, may be ſufficient, with the help of a channel to carry off the water.

If there is any mineral in the earth, eſpecially a chalybeate, which Dr. Home has experienced to be very prejudicial to vegetation; ſuch mineral, being waſhed out by the ſprings, is lodged in the ſoil, towards the ſurface.

Bogs, as I ſaid before, are fitter for meadow than arable: but, as the Memoirs of the Berne Society rightly obſerve [g], a clayey marſh, when drained, turns to better account in arable, than in paſture. This, indeed, is the caſe of all clayey ſoils, which, when not too ſtiff, produce excellent crops of corn. If their tenacity be too great, they muſt be treated in the manner directed for ſtiff ſoils. It is found by experience, that gravel, lime, and other ſubſtances of a ſimilar nature, kill the coarſe aquatic plants in a clayey marſh, after it has been perfectly drained, and ſoon cover it's ſurface with a good ſward of fine ſweet graſs.

SECT. III.

Of breaking up and improving COMMONS AND WASTE GROUND.

THE marquis of Turbilly, a nobleman of conſiderable diſtinction in France, has ſet an example in that country, which well deſerves to be particularly noticed here; firſt, on account of the great advantage attending it; and next, in hopes that it may excite in many of our landed gentlemen, that attention to their own intereſt, which the neglected condition of their eſtates calls for; and that an employment, not only beneficial to themſelves, but of great utility to the public, may get the better of their attachment to the turf, their hounds, and gaming. The many bar-

[g] *Tom.* II. *Part.* 2. *p.* 288.

ren and uncultivated ſpots in almoſt every part of this kingdom, not excepting even the moſt fertile counties, require, for their improvement, examples like this. The marquis's own account of the many difficulties he had to ſurmount, the prejudices he had to combat, the banters he underwent, and his ingenuous recital of his errors, will be the moſt valuable preſent I can here make to my countrymen. M. de Turbilly has treated the ſubject of breaking up and improving commons and waſte lands in ſo maſterly a manner, that I ſhould wrong both him and the public, were I to take any farther liberty with his judicious work, than barely to abridge ſome few parts of it, leſs ſuited to this nation, than to the country in which he wrote. — As I ſhall preſerve nearly his own words, ſo I ſhall make him ſpeak.

ARTICLE I.

The Marquis of Turbilly's *hiſtory of his Experiments*[a].

"UPON the death of my father, in the beginning of the year 1737, I inherited the lands in Anjou of which I am going to ſpeak. They lie contiguous, and form a pretty conſiderable extent.

Hills and vales render the country uneven in many places; though, in others, there are ſpacious plains, with ſeveral brooks, and a ſmall river. The ſoil is of three kinds. bad, middling, and good; but this laſt is leaſt frequent. Moſt of the lands, being of a middling quality, are fertilized only by dint of care and manure: wheat grows on one ſpot, meſlin on another, rye on a third; and ſometimes it is neceſſary to ſow theſe three different ſorts of grain in the ſame field; ſo much does the ſoil vary:

[a] *Memoire ſur les Défrichemens, Part.* II.

but,

but, in general, we ſow more ground with rye, than with any other corn. Buck-wheat, barley, oats, hemp, flax, and other equally uſeful productions are likewiſe cultivated in theſe parts. The vine proſpers here very well; eſpecially on the ſunny ſide of banks and higher grounds: our wine both red and white, is good; our fruit trees thrive well; and ſo does the white mulberry, of which I made large plantations ſome years ago. The oak, the elm, the beech, and other foreſt trees, grow extremely well in theſe lands. Such is the ſoil of this diſtrict: the climate is mild and temperate, as is the reſt of Anjou.

Three ſides of this eſtate border upon immenſe tracts of uncultivated heaths, which ſpread through the greateſt part of the province, and belong, ſome of them to the king, and others to different lords, eccleſiaſtical and temporal. However, the ſituation of my houſe, and of the chief village, is advantageous, being nearly in the center of the whole, and within about ſix miles of three pretty towns.

Such was my eſtate when I took poſſeſſion of it: not a quarter part of the land was cultivated, and even that very badly: the reſt was either abandoned by the huſbandmen, or had not been cultivated at all. Moſt of the meadows along the brooks and rivulets were become marſhes, productive of ſcarce any thing but ruſhes. The vineyards were ruined, and the woods deſtroyed. A third part of the farms belonging to the principal pariſh where my ſeat is, were un-tenanted, for want of farmers to rent them. The inhabitants of this place were very poor, and did not, in general, raiſe corn enough of any kind to ſubſiſt them half the year: nay, ſuch was their indolence, that they choſe rather to ſtrol about and beg during the other half, than be at the pains of

beſtowing proper culture upon their land, which with that culture, would have maintained them decently.

This deplorable condition of my eſtate, which I have here repreſented fairly, without exaggerating any one particular, determined me, early in life, to read attentively all the moſt approved writers upon Agriculture, and to obſerve carefully every improvement I met with in my travels. Even the campaigns in which I ſerved did not interrupt theſe inquires; for agriculture and arms never were by any means incompatible. Under theſe circumſtances, I reſolved to execute upon my own property, deſigns which my knowledge of the place, concern for the unhappy ſituation of it's inhabitants, and regret to ſee what ſmall returns were made by ſo large an extent of ground, naturally ſuggeſted.

I plainly foreſaw that this undertaking muſt be a work of time; neither my fortune, nor the number of hands I could procure in the country, allowing me to go beyond the clearing and improving of a certain ſpace every year. Some gentlemen of knowledge, judgment, and public ſpirit, to whom I communicated my thoughts, approved of them, commended my deſign, and exhorted me ſtrongly to carry it into execution; repreſenting, beſides the advantages which would neceſſarily accrue to me, the general benefit which ſuch an example might be of to my country, filled, as it is, with numerous tracts of uncultivated land. This laſt reflection animated me more and more.

My firſt care was, to endeavour to extirpate the ſpirit of indolence, and conſequent love of begging, which prevailed among my peaſants in general. To this end, I gave public notice of my intended improvements, with a declaration, that I would

would conſtantly employ every man, woman, or child above eight years of age, who might not have buſineſs of their own to do, on condition of their leaving off begging. At the ſame time I ordered an account to be taken of ſuch as were not able to work. Theſe I afterwards examined more particularly myſelf, and found among them ſeveral, who, though they were not fit for hard labour, were capable of doing many uſeful things, in which I accordingly employed them. By this means, my liſt of really helpleſs people was reduced to a ſmall number, which I provided for, till their relations ſhould be able to keep them by means of what they earned from me. A few, and only a few, of theſe poor objects, who either had no relations, or ſuch as in truth could not help them, became a dead charge: though this ſoon leſſened, and is now inconſiderable.

An innumerable multitude of rabbits infeſted my land. Againſt theſe I declared open war; being determined abſolutely to deſtroy them. This has already been ſeveral years a-doing, and is not yet entirely completed. Some of them ſtill remain, ſheltered in their burrows at the foot of riſing grounds, and others make incurſions from the neighbouring woods and warrens. However, they do me no great miſchief now; and even then I drove them from the place where I wanted to work.

In the month of June 1737, I begun my improvements with clearing ſome of the land near my houſe. This ground was ſo poor that no farmer would even attempt to make any thing of it, ſerved only to feed a few ſtinted cows, and was over-run with briars, thiſtles, and broom, which, being cut up, and laid in heaps, from ſpace to ſpace, were burnt upon the ſpot, and yielded a conſiderable quantity of aſhes. Theſe were then

ſpread, and immediately turned in by a ſingle plowing, leſt their virtue ſhould exhale. During the ſummer, this land was plowed ſeveral times, different ways, in order to looſen it, and endeavour to deſtroy the weeds. I had bought for this purpoſe, oxen, which are generally uſed for plowing in Anjou; but my horſes helped them, eſpecially for harrowing. Here my poor peaſants, men, women and children, were employed to break the clods and pick off the ſtones; and as I had more dung than my arable lands required, I ordered about half the quantity that is generally uſed in other places, to be laid upon this ground, which was afterwards ſowed at the uſual time. This firſt trial ſucceeded, and the crop was very good; though moſt of my neighbours were of opinion that all my labour would be loſt.

In 1738, I undertook another piece of ground, adjoining to the former, and of the ſame kind. I began in March, proceeded as before, dunged it, and had equal ſucceſs. The ſecond crop of the former ſpot was ſtill more plentiful. This ſummer I gave a thorough fallow to ten acres which had long been under corn, and ſowed part of them with hemp and flax, for a purpoſe which will be mentioned hereafter. I likewiſe recruited my vineyard, and drained my meadows. Numbers of day-labourers were employed in cleanſing the rivulet and brooks which run through them. In the winter of this year an accident happened, which had like to have over-ſet my whole undertaking. The oxen which I uſed for plowing, and which were grown lean, it was ſuppoſed through labour and fatigue, were on a ſudden covered with vermin, which eat into their fleſh: ſeveral remedies were applied, but in vain, the vermin reappearing in a few days. We knew not to what cauſe to aſcribe this diſorder, which was deſtroy-

ing

ing animals without whoſe aſſiſtance I could not proceed: beſides which, the loſs would, in itſelf, have been conſiderable. They had hitherto been fed with hay only; though the cuſtom of the country was to mix it with an equal quantity of wheat ſtraw. As I had not yet a ſufficiency of this laſt, I bought ſome, gave it to them mixed with hay, and allowed them oats from time to time when they had been hard worked. This mended them a little: but they did not recover entirely, or get rid of their vermin, till they fed on green graſs, and lay out of doors.

I begun this year to make new roads and cauſeys a-croſs my meadows, marſhes, and riſing grounds, for the eaſier conveyance to and from my fields; the old ways being often impaſſable in many places. This has been a very long and expenſive work; nor is it yet quite finiſhed. I alſo bought at this time a number of ſheep, which have ſince increaſed conſiderably: for, notwithſtanding the great extent of this uncultivated land, where many of them might eaſily have been fed, none were ever kept upon it before. The people of the country thought they could not thrive there, on account of the marſhes, and of a plant very prejudicial to them *, found in ſeveral parts of the lay-grounds and commons. Moſt of theſe weeds was pulled up at a ſmall expence; and the ſheep, who are fond of this herb, eat up the reſt, which was ſo little that it could not do them much hurt, though ſome of them were ſick with it. The conſtant feeding of the ſheep, and their dung, afterwards completed the deſtruction of this noxious plant, and brought up good graſs in it's ſtead.

* M. de Turbilly calls this plant *douve:* but as he has not given it's botanical name, I cannot deſcribe it.

This

This ſhews how farmers may often get rid of any ſuch bad weed.

In 1739 I took the next contiguous land, going round my manſion: a method which I have always followed; ſo that my improvements have been, from year to year, more and more diſtant from my place of reſidence. The ſoil I now fell upon was tough, ſtrong, and only thin graſs grew upon it, with here and there a few brambles and other wild productions, which were ſoon cut up. This ground was broken up only with the plough: ſome dung was laid upon it, and I ſowed it directly with winter oats, which ſucceeded very well. My improvements of the two laſt years yielded plentiful crops, not only of corn, but alſo of hemp and flax. Theſe laſt were dreſſed, and given to the women and girls to ſpin; paying them different prices, according to the fineneſs of the thread. They applied themſelves to their work, and by degrees became perfect in it. By this means I accompliſhed my deſign of finding employment for theſe women and girls all the year round, and afforded them the means of procuring an honeſt livelihood, as well as to thoſe whom age or infirmities rendered incapable of working abroad.

The buſineſs of the field was always preferred in the ſeaſons proper for it, and when the weather permitted; keeping in my eye Cato's advice, never to work within doors, while there is any thing to be done without, nor to do that in fair weather which may be done in wet. I have continued this ſpinning ever ſince; and have allotted for the growth of hemp and flax particular ſpots, which I have incloſed with hedges and ditches, and kept in good heart and fine tilth. They have yielded plentiful annual crops without being reſted; only dunging them every other year; for

hemp does not impoveriſh the ground when it is properly cultivated. My vines, meadows, and ways were not neglected.

In the beginning of this winter I gave my oxen hay mixed with an equal quantity of rye-ſtraw, not having wheat-ſtraw enough to anſwer that purpoſe. This ſucceeded to my wiſh. My oxen continued in perfect health, free from the vermin I mentioned before, and in better plight than thoſe in the neighbourhood, which were fed with hay and wheat-ſtraw. I have continued to give them this food as long as they lie within doors, and find it anſwer extremely well. During this time they have no corn, even though they work; and I do not find that this ſuppreſſing of their otherwiſe uſual allowance of oats, renders them at all leſs hearty and vigorous. This quality of the rye-ſtraw may be of great advantage in countries where oxen are uſed for plowing.

In the year 1740, I was obliged to make a conſiderable addition to my number of ſervants, and ſtock of cattle of all ſorts, in proportion to the increaſed extent of my improvements. It may perhaps be thought, that ſo many ſervants would eat me out of houſe and home. This I had guarded againſt from the beginning. All thoſe employed in my huſbandry lived by themſelves, in ſome of the out-houſes, where they had their own kitchen, and a certain ſtated allowance, ſuited to their uſual manner of life; ſo that they had no ſort of connection with the others, whoſe more immediate buſineſs it was to attend me.

The land which I improved this year was covered with heath, broom, and furze, which had grown very thick and high. In the ſpring, when the weather was dry, I ſet fire to this ſurface, after taking due precautions to hinder the flames from ſpreading too far. The whole burnt very well, and I was in hopes of being able to plow up this

this ground without paring off the turf, as I had done with my other land the year before. This would have been a conſiderable ſaving; eſpecially as the aſhes were ready ſpread. But I ſhould have conſidered that different lands require different treatment. Ploughs, ſtronger than uſual, were made on purpoſe for this work; but the roots of the furze and broom, which had reſiſted the fire, broke them; and though I doubled the number of my cattle for draught, ſeveral of the oxen were ruined by this hard work, in which I perſiſted with too much obſtinacy. In vain did I plow it over and over, and break every clod both before and after ſowing it; the broom and furze were not deſtroyed, but made new ſhoots every where: the land continued unkindly and ſour, and the oats which I ſowed in it yielded ſcarce any crop; in ſhort, repeated plowings and dunging were neceſſary during three years, before it could be brought to a good tilth, or thoſe noxious plants be quite extirpated *. I came badly off in this experiment: but my former improvements, which I had continued to manure and ſow, luckily produced an abundant crop: that of the laſt year yielded a good quantity of wheat, which kept up my eſtabliſhment, though it did not compenſate for the loſs I now ſuſtained. However, this diſappointment did not diſcourage me. It raiſed the laugh of the whole country at my expence; eſpecially of thoſe who had foretold from the beginning, that I ſhould not ſucceed. I gave them the hearing, and only reſolved not to fall a ſecond time into the ſame error.

This year I eſtabliſhed a nurſery of fruit trees, and alſo of foreſt trees from other countries. This

* This has been abundantly experienced by every perſon who has attempted to improve heaths in this manner in England.

nurſery,

nurſery, which ſucceeded very well, was of great advantage to me afterwards, to fill up the different plantations which I made as my improvements extended. I likewiſe repaired my woods, which had formerly been deſtroyed by cattle and deer. I ſurrounded them with ditches planted with hedges, in order to bring them into regular yearly cuttings; to which end I grubbed up ſuch trees as were ſtinted in their growth, and filled every empty ſpace, either with young plants, or the ſeeds of others, according to the nature of the ground. By continuing to do this every year, my woods are now in excellent order, and afford regular cuttings, at the ſmall expence of keeping the fences in repair.

In 1741, I had the ſame kind of land to deal with as the year before; but took care not to commit the ſame fault. Each day's cutting of the heath, broom, &c. was burnt, with proper precautions, as the workmen advanced, and the whole ſurface was dug by hand as it was cleared. By this means, the aſhes of theſe plants preſerved their fertilizing quality, and their roots were pulled up. Women and children ſhook the earth from off theſe roots, and turned them, whilſt they were drying in the hot weather. Theſe were alſo laid in heaps from ſpace to ſpace, and burnt upon the ſpot, where they yielded ſome aſhes, which were ſpread, and immediately buried with one turn of the plough.

During the ſummer, this ground was plowed ſeveral times; each time, in a direction different from the former. My cattle were but little fatigued with this work; the heath, broom, &c. was almoſt entirely deſtroyed, and the ſourneſs of the land was in a great meaſure cured. I had then begun to make compoſts, which were mixed with the dung of the ſtall and ſtable, and proved of ſingular

ſingular benefit*. With their help, I was enabled to manure my newly broken up land ſufficiently; that is to ſay, to lay upon it half the quantity that is generally uſed of dung for the common run of lands. I ſowed this piece with rye, which yielded a plentiful crop. The crops from my former improvements, which I continued to ſow without reſting them, were likewiſe very good this year, excepting that of the laſt, which was alſo under rye, and yielded but a middling produce. My vineyards were now brought into as good order as any in the province; and I continued draining my meadows, and making roads and cauſeys.

The war then calling me into Bohemia and Bavaria, I foreſaw that I ſhould be abſent ſome time, and conſequently not able to ſpend part of the year in the country, as I had uſed to do; to give directions to my people, and ſee my orders executed. Under theſe circumſtances, that my improvements might not ſtop, I gave the direction of the whole to an intelligent ſervant, who had lived with me a long while, and was married to an excellent houſe-wife: and, to intereſt him the more in the future ſucceſs of the undertaking, I agreed to allow him half of the profits of every kind; ſubjecting him to this only reſtriction, that he ſhould not impoveriſh the ground by too many crops. In this ſtate things went on till the end of the year 1748.

In the mean time new pieces of land were broken up every year; but not ſo extenſive as the former; the expence of my campaigns not permitting me to lay out upon them ſo much money as before. I even ſtreightened myſelf, not to interrupt the progreſs of my improvements; which, in general, ſucceeded very well. I alſo revived an

* For the manner of making theſe compoſts, which is the ſame as M. de Turbilly's, ſee p. 119.

old method of breaking up land, by cutting off the ſurface with a *paring mattock*, and then burning it. This inſtrument (of which a drawingis given in *Fig.* 6 and 7, *Plate* III.), and the whole proceſs of this operation, which experience has taught me to bring to greater perfection than was known before, will be particularly deſcribed in the ſecond part of this account of my improvements. My reaſon told me that the method muſt be good, and I have found it anſwer. — Great numbers of trees, eſpecially poplars, with which I began, were planted by my direction, and have proſpered exceedingly. Several of them are now upwards of an hundred feet high, and form delightful walks in the vallies around my ſeat, to which they are a great ornament.

During the whole of this time, I was but two years together without viſiting my eſtate, where my preſence was then very neceſſary. In all the other years, I gladly accepted the leave which was given me to ſee how my works went on; though I ſometimes did not ſtay above a fortnight among them. However, this was enough to give an eye to every thing that was doing; which is of great conſequence in undertakings of this kind.

Peace being reſtored, I reſumed the perſonal guidance of my affairs in the beginning of the year 1749, and placed my old ſervant in a farm which I had to let, where his profits ſat him down at his eaſe. Though he was extremely faithful, and my improvements were carried on very well, yet I found that, for want of due care and attention at certain times, the crops were not equal to what they had been under my immediate direction: a circumſtance which plainly ſhews, that a work

work like this never thrives ſo well as in the hands of the owner himſelf.

I now reſolved to purſue my improvements as before the war, that is to ſay, to break up larger tracts of ground every year, than had been done of late. Moſt of my yet uncultivated lands were, and had been from time immemorial, thick covered with high broom, heath, fern, &c; and experience had taught me that theſe were not to be broken up with the plough alone.

Of all the methods which I tried, none ſeemed to me, as I ſaid before, ſo good as the paring-matto k and burning. I therefore fixed upon this, and, in conſequence, ſent for the workmen I had formerly employed in trials of this kind: but their number not ſufficing for the extent of ground which I purpoſed to break up this year, I ſent for others from a diſtance, and was weak enough to let theſe laſt, perſuade me to contract with them at a ſet price, for paring the whole ſurface. I agreed to give them even more than they ought to have had for doing the work ever ſo well; for I was not yet thoroughly acquainted with the nature of this buſineſs. They began it in March; and, to earn their money the more eaſily, or rather to rob me, only ſkimmed off the meer ſurface, without hardly touching the roots of the plants, which they ſhould have cut up. When this work was done, as they called it, for the burning part did not belong to them, they immediately came to me, and aſked for their money, which I, ſimply, gave them; not ſuſpecting the cheat, but only thinking they had earned it very ſoon. When the turf of their cutting was dry, I ordered it to be laid in heaps, and burnt. The ſmall quantity of aſhes which it yielded, made me ſuſpect the roguery: but when I found that the roots in the earth broke ſome of my ploughs, in cutting

cutting only a ſingle furrow to cover the ſeed, and that there was no clearing it of clods, I was thoroughly convinced that I had been the dupe of theſe people, and that this paring would be of little ſervice. The wheat ſowed in this ground roſe indeed pretty well, and looked tolerably during part of the winter; but not being able afterwards to ſtrike through the cruſt formed by the remaining matted roots of the plants, moſt of it died, and the little that remained ſcarcely returned the ſeed: nor could this land be recovered till the next year, even by plowing, breaking the clods, and dunging.

The bad ſucceſs of this experiment, upon which a great deal of money had been thrown away, tried my patience, but did not diſcourage me. My neighbours began anew to exclaim againſt my projects, as they called them; and numbers of thoſe people who are determined at all events to oppoſe every novelty, be it right or wrong, were pleaſed to vent their ſarcaſms at my expence. I let them talk on. The roguery of the people who had laſt pared my ground did not hinder me from ſtill thinking that this was the beſt way of breaking up new land, eſpecially heaths; and the event has ſhewed that I was right. This check, which was the laſt I received, made me reſolve to take my meaſures better for the future.

The reſt of my improvement yielded very good crops this year, during which I continued to mend my roads and meadows. Theſe long winded works, for which only a certain ſpace of time, and a certain ſum of money, could be allotted every year, have been continued ever ſince, and indeed are not yet finiſhed. I likewiſe bought this year ſeveral hives of bees; though I had ſome before. Theſe uſeful creatures have multiplied exceedingly; eſpecially in a little garden, where my chief

apiary is, ſituated between meadows and heaths, of the flowers of which they are remarkably fond. Though theſe induſtrious inſects thrive perfectly all over the country I am ſpeaking of, yet the inhabitants of theſe parts not only have not a tenth of the number they might keep, but ignorantly follow the old barbarous cuſtom of deſtroying the bees, when they want their honey; inſtead of only taking the filled comb out of the hive, as is advantageouſly practiſed in other places *.

I did not agree by the piece for breaking up the land I intended to improve in the year 1750, leſt I ſhould be again deceived; but hired proper labourers by the day. They began their work in March, and finiſhed it about the middle of June; cutting all the way deep enough to go under the cruſt, or net-work, formed by the roots beneath the ſurface; for I took particular care to ſee that this was done. When the turf thus pared, to the thickneſs of about four inches, was dried, piled up, and burnt in heaps from ſpace to ſpace upon this ground, it yielded a conſiderable quantity of aſhes, which enriched the ſoil for a long time. Wheat was then ſowed, and the plough eaſily turned up the furrow which covered the ſeed. Women and children eaſily broke the clods of this ground, which was thereby at once brought into good order; the roots of all the wild plants having been effectually cut through, and their ſeeds deſtroyed by the fire. My wheat, by this means un-incumbered with noxious productions of any kind, flouriſhed well, and yielded an excellent crop; as alſo did ſuch other parts of my land as were under corn. The ſucceſs of this year

* Or the ſtill better method of keeping them in boxes, which will be particularly explained hereafter, in treating of the proper management of Bees.

revived

revived my hopes. I now perfected my method of making artificial dung, which, as I have already obſerved, proved of infinite ſervice; and, for manuring my more diſtant lands, I built upon them perpetual kilns, which have always ſupplied me with a ſufficient quantity of aſhes.

This year I began to plant white mulberries, in order to feed ſilk-worms, and make the inhabitants acquainted with the management of them. I have ſince continued to make plantations of this kind every year, and find them anſwer perfectly well, eſpecially in light ſoils. Several of them are a uſeful embelliſhment to proper parts of my improved lands, and I have allies of them, which, though not ſuffered to run up high, form a very pleaſing proſpect.

In 1751, I again ſucceeded perfectly well in my new method of paring and burning. All my cultivated lands now yielded very good crops; and that in particular which I had broke up laſt year, and ſince dunged properly, that is to ſay with half the quantity commonly uſed upon ground in general, produced more than any other equal ſpace had yet done. From this time I continued to dung all my grounds which were broken up in this manner, every alternate year.

My improvements were now become ſo extenſive, that I was again obliged to increaſe the number of my ſervants, and of my plowing cattle. The ſame thing happened more than once after this; but I ſhall not mention it any more. My cattle too, of different kinds, had multiplied ſo much, that I had no longer room for them in the old farm-yard, or buildings belonging to it; but plainly ſaw, that if my improvements were enlarged every year in the manner they had hitherto been, I ſhould ſoon want more yards, and more buildings, to keep them in. I accordingly marked

out proper places for this purpoſe, and drew plans for more ſpacious buildings.

As the cattle in this country are ſmall, I bought ſome of a larger ſize in Poitou (from whence we generally have our working beaſts), and particularly a fine bull, to try if I could mend our breed, and thereby have of my own oxen ſtrong enough for the plough; by which means I ſhould ſave the expence of buying them elſewhere. I have not yet ſucceeded in this, ſo far as I could wiſh; probably becauſe my paſture is not yet good enough. However, my bullocks, proceeding from this race, are much ſtronger and bigger than thoſe I had before, though not large enough to be yoked to the beam, but only before or with others.

The ground which I broke up in 1752, was pared and burnt in the ſame manner as that of laſt year, and produced an equally good crop. My other corn lands did the ſame; and I have ſince continued, and ſtill continue, at the time of my writing this, to break up a parcel of heath, or other waſte-ground, every year. The ſucceſs has anſwered; ſo that my improved lands now yield me every kind of corn which this country produces. Turky-wheat, buck-wheat, and millet, have done extremely well in ſome parts of them; and ſo have flax, hemp, and other productions ſuited to the different qualities of the ſoil. In ſome places I have ſowed, at different times, ſeveral ſorts of trees, ſuch as the oak, the beach, the cheſnut, the firr, and others, all of which thrive wonderfully. I have likewiſe planted new vineyards, and find them anſwer perfectly well. All theſe trials convince me more and more, that the very beſt way of preparing land, is by burning it, as I have already ſaid more than once. Thoſe who were formerly the readieſt to blame my undertakings, now ſee their error, and commend them.

During

During this ſame year 1752, as well as in the courſe of the following, I drained ſeveral marſhes, and improved other pieces of uncultivated ground, which, not being of the heath kind, or proper for paring, were broken up, and fitted for their reſpective crops, whether of corn, or of other plants, as will be more fully related in the ſecond part of this account. I likewiſe ſowed in theſe, as I had done before in other places, trees of every kind, ſome of which have ſucceeded, and others failed, according to the ſoil, and the manner of preparing it. This alſo will be more fully noticed hereafter, when I ſhall ſpeak particularly of the different methods of raiſing trees from their ſeeds; and of the means of obviating the three chief difficulties, which muſt of neceſſity be guarded againſt or removed, before one can properly ſet about breaking up any ſort of ground; theſe are, water, ſtones, and large roots; each of which I have found it neceſſary to get rid of, before I could rightly begin any of my improvements.

I endeavoured this year to make ſome progreſs towards perfecting my inſtruments of huſbandry; my new buildings went on according to the plan I had laid down, and were extended from time to time, in proportion as the products of my enlarged improvements, and the increaſe of my ſtock of cattle, required more room. I likewiſe tried to mend the breed of horſes in this country, where their chief fault is, that they are too ſmall.

My ſheep were alſo of too ſmall a ſize, and yielded but little wool; which indeed is the caſe throughout all this province. I therefore got from lower Poitou, in the year 1753, two fine rams, of the large kind, called *Flemiſh*; by which means my lambs are much ſtronger than any other in theſe parts. Several of the males are almoſt as large as their ſires, and I have given ſome of them

to my neighbours for rams. They have produced a baſtard breed, which increaſes apace, and, though not ſo large as the flemiſh, yields more and better wool than our former breed. I got rid of all my old ſheep by degrees, and have now a well-ſized flock: nor do I doubt but that if I could conveniently have purchaſed a whole flock of theſe large ſheep, their breed might have been preſerved without degenerating, and increaſed ſo as to ſupply the place of our preſent inferior ſpecies; for our uncultivated lands would feed a much greater number of ſheep than we even attempt to raiſe.

I folded my ſheep in 1754, though contrary to the cuſtom of the country, where this practice was quite unknown. As I had intended it for ſome time paſt, I had prepared proper hurdles, and a little wooden hut, upon wheels, for the ſhepherd to lie in. This fold was pitched upon the land firſt broken up, in the fine ſeaſon of the year, as is the cuſtom in other places; and a man was ſent every morning and evening to help the ſhepherd to remove the hurdles. This method, though criticiſed at firſt, ſoon proved very advantageous, and I have continued it ever ſince at the proper ſeaſons. My land is thus excellently well dunged by degrees, and the ſheep, by lying abroad, are more healthy, and have better wool, than before.

My only difficulty in this affair was occaſioned by the wolves, of which there are great numbers in our immenſe heaths and foreſts. They tried ſeveral times, at firſt, to break into the fold; but I had taken care to give the ſhepherd good dogs, and a gun; to which I added the farther precaution of ſending a ſervant to ſtay with him every night. By this means, thoſe ravenous animals were kept off; for the wolf is exceſſively afraid of gun-powder: nor have they ſince often

attacked

attacked the fold, or ſucceeded better in their attempts, though the ſhepherd has frequently been left alone, with only his dogs.

I met, this year, with ſuch an inſtance of the increaſe of corn, as ſome may think incredible; but I ſhall relate the fact. A grain of barley had accidentally dropped, in the ſowing ſeaſon, upon an old dead ant-hill, in a heathy ground, about ten feet diſtant from the edge of one of my improvements. This ant-hill was then a perfectly fine mould, formed of the rotten particles of what the ants had formerly treaſured up in it, and of thoſe inſects themſelves which had died there. This grain grew, and put forth ſeveral ſhoots. I obſerved it in the winter, as I was viſiting my corn; and, curious to ſee what it would come to, ordered a dry hedge to be made round it, at the diſtance of ſome feet, to ſecure it from the cattle. It continued to thrive, being in quite open air, without any thing to obſtruct the growth of it's ſhoots or roots, and at length formed a kind of little ſheaf. In July, when it was ripe, I reſolved to reap it myſelf. Several of the neighbouring gentry happened then to be at my houſe, and I propoſed to them to go with me. We accordingly went, and dug up this little ſheaf, with it's roots, and, as plainly appeared when the earth was ſhaken off, the yet remaining huſk of the grain which had produced it, from whence all the roots were evidently derived. We then picked out the corn, upon a ſheet, and reckoned the produce, which amounted to fourteen hundred and forty grains of as large, fine, and ſound barley as any of us had ever ſeen. This ſurpaſſes all the wonders we read of the fertility of Judea and Egypt in ancient times. I am very ſenſible that no one grain of corn would have produced an increaſe any thing like this, if it had been cramped in a

field, in the midſt of other plants: but this inſtance ſhews, that we are very far from knowing what our lands are capable of producing, with proper management.

I attempted this year to raiſe ſilk-worms, in order to judge whether theſe uſeful inſects would thrive with me, and whether, according to the event, I ſhould continue or ſuſpend my plantations of white mulberries. The ſucceſs anſwered my deſire.

In 1755, I diſcovered lime-ſtone upon my own land. This proved a conſiderable ſaving; for I had hitherto been obliged to fetch my lime from a diſtance of near twelve miles. This ſtone, if properly ſearched for, may often be found in places where it is not ſuſpected to lie. It is eaſily known, by putting a piece of it into the fire till it be calcined, and then diſſolving it in water. This diſcovery, in conſequence of which I built a proper kiln, has enabled me to carry on my buildings with leſs expence than before, and is of ſignal ſervice in affording an excellent manure for my land *.

I began this year to give premiums for Agriculture to the inhabitants of my eſtate. They were inſtituted the year before; and I had long uſed my beſt endeavours to inculcate a general love of induſtry, and a reliſh for improvements. My ſucceſs had induced ſeveral others, both land-lords and farmers, to follow my example, as well in amending their already cultivated lands, as in the breaking up of new grounds. I aſſiſted them in their undertakings, giving inſtructions to ſome, lending ſeeds to others, and money and tools to ſuch as were honeſt and wanted them. The better

* M. de Turbilly's remarkable improvement of a bog, this year, has already been noticed in p. 161.

to encourage them all, I had given rewards every year to thoſe who diſtinguiſhed themſelves moſt, and allowed my tenants ſixteen ſhillings for every acre of new ground broken up by them: a regulation which ſtill ſubſiſts.

To fix theſe people in the induſtrious diſpoſition to which I at length had brought them, no method ſeemed to me more proper than to take them on the weak ſide of almoſt all mankind, intereſt and vanity. Accordingly, I notified in the month of January 1754, that I would diſtribute every year, beginning on the next enſuing feſtival of the Aſſumption, two premiums for agriculture; one, to the perſon who ſhould raiſe the fineſt crop of wheat, and the other to him who ſhould have the beſt field of rye. Each of theſe premiums conſiſts in a ſum of money, not inconſiderable for the country where it is given, and a ſilver medal, engraved for the purpoſe, of the ſize and value of a crown piece. Theſe were, I believe, the firſt premiums ever propoſed in France for this moſt uſeful object; though many have been given for much leſs intereſting concerns. On one ſide of this medal is a ſheaf of corn, with two ſickles, a ſcythe, and a flail; over which are the words, *Premium for Agriculture*, and underneath, the date. On the other ſide are my arms, with this inſcription round them: *To excite to Induſtry the Inhabitants of, &c.* I would not put the Goddeſs Ceres of the ancients, or any emblematical figure upon this medal, becauſe, in the firſt place, the ignorant peaſants would not have underſtood it's meaning, and in the next, ſome of them might perhaps, hereafter, take it for the repreſentation of a Saint, and honour it as ſuch; by which means, what I intend only for an object of utility, would become a ſource of ſuperſtition or idolatry.

A candidate for theſe premiums muſt have at leaſt two acres of land ſowed with either wheat or rye: they are given to the fineſt crop as it ſtands, to avoid all tricks; and if two crops are deemed equally good, the worſt ſoil has the preference. When both the crops and the ſoils are alike, the largeſt extent of ground is entitled to the reward. The inhabitants of the place, in general, meet at the pariſh church on the day appointed; and, after divine ſervice, chooſe from among themſelves five who are not candidates, to inſpect all the fields of corn, and mark thoſe which they think the fineſt. On the next ſunday or holiday, they make their report to the ſame aſſembly. If any one complains that his corn has been unjuſtly paſſed over un-noticed, proper perſons are immediately ſent, to examine whether the complaint be juſt. The aſſembly then appoint the ſame five as before, or others if they pleaſe, to go and inſpect again, with the utmoſt care, the fields which they had marked, and to judge which two of them, one of wheat and the other of rye, beſt deſerve the premiums. On the next ſunday or holiday they declare their opinions to a general aſſembly of the pariſhioners, as before; and, if no objection be made by any of thoſe whoſe corn has been marked, this aſſembly adjudges the premiums accordingly: but if any one of them appeals, other proper judges are immediately choſen, and directed to inſpect the ſpot. On the next ſunday or holiday, till which the deciſion of the premiums is, in this caſe, of courſe put off; theſe laſt examiners make their report, and the matter is then determined. All the people thus ſent by the aſſembly, are paid at my expence. In conſequence of the deciſion of the inhabitants, the premiums are delivered publicly on the feaſt of the Aſſumption, after the ſervice at church is over. Thoſe

who

who win them, wear the medal, for a year only, faſtened with a green ribbon to a button-hole of their coat, and have, likewiſe for that time, a diſtinguiſhed ſeat in the pariſh church. Theſe marks of diſtinction ceaſe at the end of the year, when others ſucceed to them; but the medal remains the property of the perſon to whom it was adjudged. He may diſpoſe of it as he pleaſes: yet, though he is no longer allowed to wear it on the outſide of his cloaths, there has not been a ſingle inſtance of any one's ſelling his medal. They all keep it as a badge of honour.

Theſe rewards have been productive of ſo much good, and have raiſed ſo extraordinary an emulation among my tenants, that I cannot but adviſe every gentleman to practiſe the ſame method upon his eſtate. I intend to inſtitute ſome others, for different productions; and as I am far from having a ſufficient number of people to manage all my lands, if the whole of them was under culture, I have long thought of giving gratuities to ſuch as ſhall have a child within the firſt year of their marriage, to continue this allowance to them ſo long as they ſhall have a child from year to year, and to allot a pretty conſiderable ſum for the family which ſhall have moſt children. Some may, perhaps, think theſe encouragements for propagating the human ſpecies, odd, and even ſuperfluous: but they will be of a different opinion when informed, as they may be by the miniſters of moſt country pariſhes, that many peaſants are unwilling to get children, or at leaſt do not chooſe to have more than a very ſmall number, when they might have a numerous offſpring. If my abilities were equal to my will, I ſhould already have formed all theſe uſeful eſtabliſhments. It is generally allowed, and experience has particularly demonſtrated it upon my eſtate, that an increaſe

of

of culture produces an increaſe of inhabitants; and that wherever there is room for two, with the means of ſubſiſting them, a marriage will enſue: but at the ſame time that this means of increaſing population is encouraged by a more extenſive culture of the earth, I ſee no reaſon why proper methods ſhould not be uſed to induce men likewiſe to concur in the ſame laudable end.

Ever ſince the year 1756, I have continued all my undertakings, and with the ſame ſucceſs as before. Thoſe who ſaw the condition of my eſtate when I firſt came to it, in the year 1737, now ſcarcely know again a ſingle ſpot of it; ſo much is the face of the country changed. My manſion-houſe, which was formerly ſurrounded with dreary waſtes, vaſt commons, and unbounded heaths, now ſtands in the middle of well cultivated fields; my improvements are become conſiderable both for extent and value; producing all ſorts of grain, and natural as well as artificial graſſes. I have diſperſed in them all kinds of fruit trees, and divided them into fields of proper ſizes, ſeparated by good ditches planted with quick hedges. Allies of limes, poplars, white mulberries, cheſnuts, and various other trees, beſides being a conſiderable embelliſhment to the whole, afford convenient paſſes from one field to another, yield food to cattle, and are ſown from time to time. I turn every thing to profit; even my drieſt ſoils. Many of my marſhes are drained, and yield good crops. All my meadows, by reaſon of their great extent, are not yet brought to the ſtate in which I wiſh to ſee them; though a great part of them now produces excellent hay. I have mowed ſome of them twice a year, and hope by and bye to do the ſame to others; for I intend to water them all, by making dams and ſluices in the brooks and rivulet which paſs through them.

My

My vineyards are in good order; and my woods, which are now in regular cuttings, thrive perfectly. Some of these, which I have raised from the seed, have grown so prodigiously, that a stranger would think them much older than they really are. I have made some large reservoirs of water, and several ponds, intirely new, besides repairing the old ones. All these have succeeded, and yield good fish. A quarry of mill-stones, formerly abandoned, now turns to good account, and I have discovered several quarries of free-stone.

I have been obliged to make several bridges over the brooks and rivulet which divide my meadows and marshy grounds, and have carried my roads as far as my improvements extend. Some of these roads lie over hills, which could not be avoided; though others have been cut through, at a great expence. Most of my out-houses, which are pretty spacious for all my cattle and all the produce of my land, with proper buildings for poultry, barns, granaries, &c. are finished; and I have built farm-houses with the stones which it was necessary to take off the lands, in different parts of my improvements, and settled in them young men, who are now married, and have children. Though my barns are very large, and not few in number, I have the pleasure to find that they would not contain all my last year's crop of corn: a satisfaction which I hope to enjoy still more amply in the next and following years.

Thus my estate, which formerly yielded scarce any thing, now affords every necessary for food and rayment. When there, I can, truly speaking, keep a very good table, and be decently cloathed, with only the produce of my own improvements. I have no occasion to buy any thing, except salt, sugar, and spices. My farmers have followed my example,

example, ſo far as their means, and the helps which I have given them, have permitted.

Theſe improvements have, undoubtedly, coſt me a great deal of money; but my income from them will ſoon be proportionably increaſed: beſides which, it is proper to obſerve, that few lands will require ſo great an expence to break them up, as mine have done; owing to the uncommon ſtubbornneſs, inequality, and unkindlineſs of the ſoil: nor will it often be neceſſary to cut through hills in order to make roads, to lay cauſeys over quaking bogs, or to erect ſo many new buildings: though, even if all theſe difficulties ſhould occur, I would ſtill adviſe gentlemen to undertake the improvement. If they follow the directions hereafter given, and profit by my errors, ſo as not to commit the like, I can aſſure them of ſucceſs, at a much leſs expence than it has coſt me, who have thoroughly paid for my apprenticeſhip. I can alſo promiſe, that they will lay their money out at better intereſt, and on better ſecurity, in this, than in any other way: beſides which, they will have the heart-felt ſatisfaction of contributing to the proſperity of their country, to the increaſe of population, and to the enriching of others, at the ſame time that they enrich themſelves*.

I have already ſaid, that when I began my improvements, two and twenty years ago, a third part of the farms in my pariſh were untenanted, for want of farmers who would rent them; that moſt of the inhabitants of my eſtate were very poor, and did not, in general, reap corn enough to

* If the marquis of Turbilly is ſo poſitive of ſucceſs in France, and that he is right in inſiſting on it, even there, appears from repeated facts; how much more we may be aſſured of of it in this kingdom, where the tenant has only one tax, *viz.* tithes, to pay, inſtead of the innumerable impoſts with which the farmer in France is cruelly oppreſſed!

ſupport

ſupport them half the year; that they were grown ſo indolent, that rather than cultivate their ground, which would have afforded them a maintenance, they choſe to beg, like vagrants, in the neighbouring diſtricts. Now, their ſituation is very different, and they are no longer in that deplorable condition. They are become induſtrious, live by their labour, and beg no longer: they would even be at their eaſe (a happineſs which I ſhall do my utmoſt to procure them), were it not for obſtacles beyond my power to remedy. The pariſh now reaps more corn than it conſumes; ſo that the farmer here is enabled to ſell at the very markets where he uſed to buy. All my farms are tenanted; not a houſe on my eſtate is empty, and if I build a new one, it is immediately filled; in ſhort, the number of inhabitants in this pariſh, for I have an exact liſt of all of them, is double what it was in 1737. Such is the hiſtory of my improvements, and ſuch are the effects with which they have been attended.

What a private gentleman has practiſed with ſucceſs on his own eſtate, might ſurely be executed to ſtill better advantage by an infinitely greater and more powerful lord: I mean, the king, who has far more extenſive means of ſucceeding in ſuch an enterprize.

The farmers of the king's revenues aſked the baron of Roſny *, ſoon after his entering into the miniſtry, whether he intended to manage the affairs of France, as he had managed his eſtate at Roſny: to which that great man anſwered, that

* More generally known by the reſpectable name of DUKE OF SULLY; to which dignity he was moſt deſervedly promoted by one of the beſt of king's, HENRY IV, of France, who, ever ſtudious to promote the welfare of his people, long eſteemed it an eſſential part of his happineſs, that he had ſuch a miniſter, and ſuch a friend.

he

he did. The infinite good which he did during his thirteen years adminiſtration, proved that his plan was right. The principles upon which an eſtate is rightly managed, are the ſame as thoſe for well governing a kingdom; but the manner of applying them is often different."

ARTICLE II.

The Marquis of TURBILLY's *Experiments in breaking up and improving* UNCULTIVATED LAND.

"UNcultivated grounds are commonly divided into three kinds; *viz.* Bad, of which I ſhall ſpeak firſt; indifferent, which will be my next ſubject, and good, with which I ſhall conclude. — The regular proceſs of breaking up lands requires my obſerving this gradation.

The lands which all the world look upon as bad, and which really are the worſt, are thoſe ſharp burning ſands which are fit to make mortar, when mixed with lime. Some of them are white, others yellowiſh, and others red. They are generally abandoned, as quite barren. But the all-wiſe Creator has not made any thing in vain: He has ordered man to cultivate the earth, and told him he ſhould draw his ſuſtenance from thence; without excepting bad ſoils: for in effect, there is no ground, however unpromiſing it may appear, but will produce, when rightly cultivated, and pay for the care and labour beſtowed upon it.

Some of theſe ſands do not naturally produce any thing at all: but ſuch are rare. Others afford only moſs, or ſhort heath, growing very thin, with here and there a few piles of graſs intermixed. If they do not yield ſo much as other ſoils, their culture is grealy cheaper. The three obſtacles, of water, ſtones, and roots, which muſt firſt be got rid

rid of, will ſeldom be met with here. If they do not produce any thing, they may be croſs-plowed, and ſowed in the manner I ſhall direct. If they produce little ſhort heath, intermixed here and there with a few blades of graſs, theſe may be burnt as they ſtand. If the heath be in ſo ſmall quantity, and ſo widely ſcattered that the fire cannot communicate from one tuft of it to another, it will be eaſy to dig up thoſe roots which either interrupt the plough, or are not pulled up by it, in order to their being burnt. This ground ſhould be plowed in the beginning of ſpring, in dry weather, with a common plough, having only the addition of one fin to the ſhare, as on either ſide of *Fig.* 9, *Plate* III. A fortnight after this, it ſhould have a ſecond plowing a-croſs; the purpoſe of which is to deſtroy the roots of the coarſe graſs or ſhrubs. At the end of another fortnight, women and children ſhould be ſet to pull up the remaining roots, ſhake the earth off from them, and lay them by to dry. When dried, they ſhould be laid in heaps from ſpace to ſpace, and burnt. Their aſhes are then to be ſpread, and immediately turned in by a third plowing.

Some time after this third plowing, the ground ſhould be harrowed with a very light harrow, then enriched with a manure ſuited to the ſoil, and afterwards ſowed with buck-wheat.

This grain is not to be deſpiſed: it yields greatly, ſells well, and is very proper to fatten ſwine or poultry. Even bread is made of it in many parts. It is the beſt grain for theſe kind of ſands, in which it delights. The crop in autumn will amply repay the expence of breaking up this ground.

If it be not intended to ſow this land with any other kind of grain, the ſtubble of this may be plowed in as ſoon as the crop is off the ground, and when manured and properly plowed in the

ſpring, it may be ſowed again with the ſame corn.

The ſecond crop, which will be better than the firſt, will be a clear profit. This land ſhould then be reſted a year; after which it may be ſowed every alternate year, in the ſame manner as before, with buck-wheat, which will thrive well in it. It is hardly poſſible, with a leſs expence, to obtain a tolerable income from ſuch poor land, which, in general, yields no profit whatever.

If this land be intended for wood, it need not be dunged at all; and after the firſt crop of buck-wheat, which it is always adviſeable to take, whatever be the future deſtination of the ground, it is ready for ſowing with the ſeeds of ſuch trees as delight in this ſoil; of which a particular account will be given when we come to treat of foreſt trees.

If this hungry ſand be deſtined always to produce corn, pulſe, or other crops; either becauſe land is ſcarce, or that there is no better, or becauſe it lies near a town or village, or other place from whence manure can be eaſily had, or from any other reaſons of profit or pleaſure, without which I would not adviſe any one to attempt it; it will then be neceſſary to give it a more laſting dreſſing.

To this end, dig holes at certain diſtances, till you reach a ſtrong rich earth, which is always found under ſand. Lay a ſufficient quantity of this earth, that is to ſay, as much again as is generally uſed of marle for plowed ground, upon the ſurface of this ſoil, in little heaps, near one another. The poorer, drier, and hotter the ſand is, the more there ſhould be of theſe heaps. This may be done without carts, horſes, or oxen, by means of wheel or hand barrows. Then fill up all the holes out of which the rich earth was taken, with ſand from the ſurface.

This

This work may be done at the leaſt buſy times, and will not be near ſo expenſive as might be imagined; for theſe ſands are very eaſy to dig.

Theſe heaps muſt be left un-touched during all the winter and part of the ſpring, that they may be benefited by the ſun, air, dews, froſts, and ſnows, after which they will pulverize eaſily like aſhes *. They muſt then be ſpread over the land, which muſt immediately have a light plowing, to begin to mix them with the ſand. A deeper plowing ſhould be given a fortnight after, and ſo ſucceſſively, till this fat earth and the ſand are ſufficiently mixed. Theſe plowings, as well as all thoſe I have hitherto ſpoken of, ſhould be performed with a light plow; that being the beſt ſuited to this kind of ſand: a couple of heifers, or two aſſes, will often ſuffice; which will be a conſiderable ſaving.

This land is then to be manured in the ſame proportion as is uſed for other lands †, and afterwards ſowed with rye in the ſeaſon that beſt ſuits the country, the cuſtom and practice of which I adviſe to follow in this reſpect, unleſs there be very ſtrong proofs of it's being bad. The uſual times of ſowing wheat or rye in Anjou, is from the beginning of October to All-Saints. I have found by experience, that this practice ſuits the climate there.

The firſt crop from off theſe ſands, thus managed, will be good; ſuch as nearly to pay all the ex-

* I think it is better to ſpread the marle or clay, and let it lie expoſed all the winter; by which means the external cauſes muſt act more powerfully, more parts being expoſed to their influence.

† If marle be the ſubſtance mixed with the ſand, no dung will be neceſſary; but if it be clay, or marle inclining much to clay, then it will be proper to warm the ſoil with lime, dung, &c.

pence, including even that of laying on the clay or marle. The ſecond and third, for which no dung or manure will be wanted, will be ſtill better, and almoſt all clear gain; for this barren land, thus amended, will bear rye three years running. Nay it may be ſo improved, by a larger quantity of clay or marle, as to bring good wheat the ſecond and third year, and be ever after fit for wheat.

By this method I have, it is now twenty years, tranformed a piece of my dry ſandy ground, which ſcarcely produced moſs before. I ſowed it the firſt year with rye; after three years I let it reſt a year, and fallowed it with the reſt of my plowed land. It has ſince been plowed, dunged, and ſowed in it's turn; and as I have not yet perceived that it is at all impoveriſhed, this method muſt needs be ſatisfactory, and well deſerves to be called a laſting improvement.

At the worſt, if this ground ſhould hereafter happen to fall off, and it's crops be leſſened, the remedy would again be cheap, and very durable, by laying on only half the quantity of the ſame kind of earth as was uſed at firſt. I do not, however, mean by this, to adviſe any one to enter into the expence of thus rendering a hungry ſand capable of bearing wheat: I mention this inſtance, only to ſhew that the thing is poſſible and uſeful; for I ſhould be very well ſatisfied, for the good of the public, to ſee ſuch land covered with a good crop of rye, which may be had without much expence, by laying on only the firſt mentioned quantity of clay or marle. The profit will be very ſufficient.

Wheat is indeed more valuable than rye; but this laſt is a very good grain: it is raiſed more eaſily, and yields a greater quantity than the other; it is leſs liable to accidents, is much more eaſily kept,

kept, and for a longer time, and has a thouſand other well known advantageous qualities. The bread made of it is very wholeſome: more than half the kingdom of France ſow chiefly rye, and live upon it, either alone or mixed with ſome other grain. Good rye lands bear almoſt as high a price as good wheat grounds, and let much more eaſily: beſides which, I obſerve, by comparing the accounts of my yearly crops for twenty two years paſt, that as to money, my rye lands have brought me in almoſt as much as thoſe under wheat, which have coſt more to cultivate. I confeſs that the ſtraw of the wheat makes a difference; being more eſteemed, and much better for horſes, than that of rye, which however, is not ſo contemptible as is imagined by thoſe who uſe it only for litter. Beſides it's being good for cattle, when mixed with a little hay, experience has taught me, as I obſerved before, that it is excellent fodder for working oxen, when mixed with an equal quantity of hay. They keep their health better, and are more vigorous, when fed with this mixture, than when they eat hay mixed with an equal quantity of wheat-ſtraw.

It is of great importance to the huſbandman to make the greateſt advantage of all the different productions of his ground, even of thoſe which are the leaſt valued. Every one of them may be uſeful; even to the ſtalks of buck-wheat, which many leave upon the place where the grain has been threſhed, without taking any farther notice of them. I ordered ſome of them to be dried, and gathered into a cock, and gave them in the beginning of the winter to my cows, which eat them willingly as long as they laſted. They were neither diſordered by this food, nor grew lean, nor was their milk leſs good, or leſs in quantity, than before.

Thus we ſee, that a ſharp burning ſand, which does not naturally produce any thing, or only a little moſs, with ſhort thin-ſcattered heath, and here and there a few blades of graſs, may be converted into profitable land. With regard to thoſe tracts of the ſame kind of ſand which ſend forth a greater quantity of wild productions, ſuch as ſtronger or cloſer growing heath, where turf or ſods can be taken off; the ſurface of theſe places ſhould be cut off with the paring-mattock, in the ſame manner as the ſecond kind of waſte grounds, the indifferent, of which I am going to ſpeak.

Under the name of indifferent ſoils I comprehend ſuch as are light, ſandy, gravelly; but not, like the ſharp ſand, fit for making mortar, when mixed with lime. Theſe are the ſoils moſt common in France. Some of them are white, others yellowiſh, others reddiſh, others brown, and others again almoſt black. They are more or leſs fertile, according as the bed of clay, marle, or other rich earth which always is under them, lies at a greater or leſs depth from their ſurface. Their natural produce generally is heath, ruſhes, fern, broom, furze, brambles, and ſuch like, intermixed with graſs. From the height, thickneſs, and vigour of this wild growth, one may eaſily judge of the degree of goodneſs of the ſoil, and of what is to be expected from it. I have never yet been deceived in this.

When ſuch ground is to be broken up, it will be right to begin in the winter to get rid of the three obſtacles before mentioned, namely, water, ſtones, and ſuch great roots as the paring mattock may not be ſtrong enough to cut. Afterwards, about the middle of March, but not before, for the reaſon I ſhall give, the paring of this ground ſhould be ſet about. To this end, a number of day-labourers muſt be hired, in proportion to the extent

extent of the land intended to be pared. The ſtrongeſt and moſt vigorous men will be moſt expeditious; though every common labourer, good or even indifferent, may work at this buſineſs: but weak people, or ſuch as are too young, that is to ſay, under fifteen or ſixteen years of age, are not fit for it.

Each of theſe labourers muſt be provided with what I call a *paring-mattock* (repreſented in *Fig.* 6. *Plate* III.) Towards the edge, where it is ſharpened like an addice, it ſhould be of well tempered ſteel, and about nine inches wide. From thence, the iron part, which ſhould be ſix inches long, leſſens in breadth upwards to the handle (as in *Fig.* 7), where it is reduced to three inches. All this upper part muſt be made of the beſt iron, and ſhould be formed ſomewhat hollow, with a little bending inward. It ſhould be ſtrongeſt in the middle, and of a thickneſs, proportioned to it's ſize, as well as to the work for which it is intended. The hole to receive the handle ſhould be two inches in diameter; and the handle ſhould be of wood, about three feet long, or a few inches more or leſs, according to the height of the man who who uſes it *. This inſtrument, without the handle ſhould weigh from ten to twelve pounds, according to the ſtrength of the labourer: a leſs weight would not do the buſineſs.

The ſtouteſt and moſt intelligent labourer muſt then be ſingled out to lead the reſt; for they cannot here work in a row, as when they dig. This leader, ſtanding in a proper poſture to manage his

* What was obſerved before (p. 178.) in regard to ſhovels, is of equal conſequence here, *viz.* that the handle be long enough for the labourer to work ſtanding nearly upright; becauſe, not having the weight of his body to ſupport in this ſituation, as he has when he bends forward, he will not be ſo ſoon fatigued; nor will his health be ſo readily injured.

mattock, muſt give a ſtroke with it, cutting into the ſoil, firſt to the right, then a ſecond ſtroke ſtrait before him, and a third to the left; by which means he will immediately raiſe a turf about a foot and a half long, a foot broad, and four inches thick of earth †. This turf, reſting upon the mattock, as it was cut, is then, with one motion, to be placed on the labourer's right hand, in it's natural poſition, with the mould ſide downwards. All the wild growth upon this land will, if not very large, come off with the turfs thus cut; and the more there is of it, the better it will be. The turf muſt abſolutely be cut with a depth of at leaſt four inches of ſoil *: for if the ground be pared to a leſs thickneſs, the work will be badly done; becauſe

† I have here given a faithful tranſlation of my author; but apprehend there muſt be ſome miſtake in the French original: for in order to cut a turf a foot and a half long with an inſtrument only nine inches wide, the labourer muſt certainly give two ſtrokes, to form that length.

* This is too great a thickneſs to be taken off by paring-ploughs, though ſome of our Engliſh writers have recommended them for this purpoſe. One of the beſt and ſimpleſt (but by no means ſtrong enough for ſuch work as this,) is that which Mr. Bradley gives [a], with the following deſcription.

"From *A* to *A*, *Fig.* 8, *Plate* III. is the plough-beam, about ſeven feet long, mortiſed and pinioned into the block *B*, which is of clean timber, without knots. *CC* are the ſheaths or ſtandards, made flat on the inſide, to cloſe equally with the paring-plate, and be faſtened to it with a bolt and key on each ſide, as is marked at *D*.

E is the paring-plate, of iron laid with ſteel, about four inches wide, and from twelve to eighteen inches long, as the buſineſs may require. This plate muſt be made to cut on the ſides, which are bolted to the ſtandards, as well as at the bottom part.

FF are two iron braces, to keep the ſtandards from giving way. Theſe ſtandards muſt be mortiſed near their outſides, and through the block.

GG are the plough handles, which muſt be fixed ſlope-wiſe between the beam and the ſtandards.

[a] *Complete Body of Huſbandry*, p. 43. *Pl.* II. *Fig.* 1.

The

becauſe the paring mattock will not have gone under the netted roots of all the rubbiſh growing on

The pin-holes in the beam, the uſe of which is to make this plough cut more or leſs deep, by fixing the wheels nearer to or farther from the paring plate, ſhould not be above two inches aſunder".

The author of the new ſyſtem of Agriculture directs, for the ſame purpoſe, the following plough.

" Let ſome ſmith, who is a ready workman, make a hollow plow-ſhare, of a double form, that is, one which riſes with a ſharp edge in the middle, from the point to the top, and has a *fin* both ways; which fins muſt alſo begin at the point, and ſo run back to the ſhare end. The dimenſions of this ſhare will be two feet broad, from the extreme points of the fins behind; one foot long and a foot high, ſomewhat like a three-edged ſword, if it were cut off a little above the point. The three fins, or edges, muſt be very well ſteeled, and the whole made as thin, and as ſmooth, as you can get it done. ---- Into the hollow of this ſhare muſt be faſtened a light ſtrong piece of aſh, ſharpened *forward*, to fit the boſom of the ſhare, but *behind* as ſquare and ſturdy as may be. Into this laſt part muſt be fixed a ſtrong piece of wood, like a *lever*, not perpendicular but ſomewhat hanging backward. It muſt be about two feet high; and on the upper end, ſhould have a croſs ſtaff, or other contrivance, to which muſt be faſtened the harneſs of ſuch cattle as your team conſiſts of. The handles of the plough, and the *earth-boards* to turn the turf, are alſo fixed into this ſquare head; and there is no other inſtruction neceſſary for the uſe of this plow, but that, when you begin upon the edge of a field, and turn one turf to the hedge, and the other to the field, the laſt will cover one of the breadths you muſt take at your coming back, and the point of your ſhare muſt, therefore, run cloſe along the edge of this length of turf; by which means one ſide of your plough will raiſe two lengths, and, throwing back the higheſt, lay that uppermoſt, which had before lain under. By this one obſervation, you cannot miſs the manner of plowing.

" But, as this would only raiſe a long unwieldly *rope* of turf, which it would be neceſſary to cut into many hundred pieces, before it would be fit for *piling*, you will find the following invention of admirable uſe and expedition.

Chuſe the body of a ſhort thick tree; the heavier, and more ſolid the better: let it be neatly rounded, and worked into a *roller*, like thoſe that are uſed for leveling barley lands. This

roller

on the ſurface, which it is indiſpenſably neceſſary to deſtroy: otherwiſe, theſe roots will make new ſhoots, injure the corn, and in time choak it intirely, as has happened to me in the beginning of my undertakings.

The workmen, eſpecially if agreed with by the piece, would be glad to take this turf off as thin as poſſible; becauſe that would ſave them a great deal of time and labour. But I have experienced, to my coſt, the imprudence of making ſuch bargains. They muſt therefore be well watched; for otherwiſe, beſides the inconvenience of not effectually, deſtroying the wild growth, ſuch thin turf will not yield aſhes enough to manure the land. The fault of not having the turfs either ſo long or ſo wide as I have ſaid they ſhould be (a thing which may happen at firſt, till the labourers become acquainted with their buſineſs), will not be near ſo great, provided they are ſufficiently thick. The buſineſs will indeed go on ſlower; but practice will ſoon render the workmen more expert. Their leader, having cut a turf, and placed it on his right hand ſide, muſt then advance a ſmall ſtep, and take off another of the ſame ſize and thickneſs, which he will likewiſe place on the ſame

roller muſt be hooped round, in ſix ſeveral places, each two feet diſtant from another: the hoops muſt be of ſtrong iron, and nailed very firmly on—The middle part of every one of theſe hoops muſt riſe into an edge, to about five or ſix inches above the level of the hoop itſelf: theſe edges muſt be very ſharp, ſtrong, and well ſteeled, that the weight of the roller, as it goes round, may not fail to preſs them all into the earth, as deep as they can go, and yet not damage them, either by blunting, bending, or breaking.

One horſe will very well draw this roller, with which you muſt go over the ground you intend to burn, the contrary or croſs way to that which you deſign to take with your plough, before deſcribed; which will by this means turn up the turf in pieces of two feet long, and one foot broad.

ſide,

ſide, in a line with the former, on the farther end of which the neareſt end of this ſhould reſt, ſo as to incline a little. He is then to proceed ſtrait on, laying all the turfs in the ſame manner. As ſoon as he has taken up, the two firſt, the ſecond labourer, ſtanding a ſmall ſtep behind him, on his left hand ſide, is to take up his line of turfs in the ſame manner, and place them at his right, in the void ſpace juſt cleared by the leader. As theſe advance, each of the other labourers, ſucceſſively, one by one, muſt put himſelf on the left of the preceding, at the diſtance of a ſmall pace behind him, and do the ſame work; following each other like reapers. When they come to the end of the ground, which will likewiſe be in progreſſive order, the leader muſt return to the ſide where he firſt began, and reſume his work cloſe to the place already pared; the others are to follow in their regular turns, and repeat the ſame operations as before; for this work muſt always be performed in the ſame direction, and not backward and forward. Such ſhould be the method, till the whole ground is pared.

If, as it ſometimes happens, there be reaſon to apprehend that the ſods will not dry faſt enough when only laid a little ſlanting, with the end of one juſt reſting upon the extremity of another; they may, in this caſe, be piled, as faſt as they are cut, in little heaps of three, four, or five together, according to their thickneſs, and the quantity of combuſtible or vegetable matter contained in them.

The air, paſſing between theſe ſods, which are always laid with the heath or turfy ſide uppermoſt, penetrates and ſoon dries them, eſpecially if the weather be ſultry: but at the ſame time it would be wrong to wait till they are too dry, becauſe they would then burn too much and too faſt; in which caſe

caſe their aſhes are neither ſo good, nor in ſo great quantity, as thoſe of turf more ſlowly burnt. A juſt medium, which practice will eaſily teach, is to be obſerved in this reſpect.

Sometimes theſe turfs are ſet upon their ends, two and two, meeting at top and being farther aſunder at the bottom, like the roof of a houſe, with their heathy ſide outward: but this method, which lengthens the work, and is more expenſive, is fitteſt for the turf of bogs or marſhes, when cut too wet.

With reſpect to the roots which I ſaid muſt be got rid of before any land can be properly broken up, I meant, as the reader may have perceived, only ſuch large roots as the paring-mattock cannot cut through, though it is ſharpened from time to time upon a whet-ſtone, when it's edge is either turned or blunted. Roots of a ſmaller ſize, ſuch as thoſe of the dwarf-furze, the common heath and fern, ſmall holly, young plants of thorns and junipers, brambles, broom, and all other wild productions which have not attained too great ſtrength, will be cut and pared off with the turf, without much difficulty.

As to the ſtrong roots of ſhrubs and buſhes, ſuch as the thorn, juniper, holly, furze, &c. with thoſe of the large ſpecies of bull-ruſh, of what is commonly called male fern, and of other ſimilar wild productions, which the paring-mattock cannot ſever, they remain in the ground; but do not hinder taking off the turf between them, to a proper thickneſs. The ſods thus cut will indeed often be very irregular in length and breadth; but they are far from being the leſs good to burn; for they contain the greateſt proportion of vegetable matter.

As the turf is pared off, it ſhould be laid in little heaps, as I ſaid before; and theſe heaps

ſhould

ſhould be placed in the intermediate ſpaces, of which there will be enough, where the ground has been pared between the ſtrong roots yet remaining in the earth. Theſe roots may then be dug up with a ſpade or pick-axe *, without diſordering the little piles of ſods. It is ſufficient that this work be finiſhed before the time of ſowing.

Some grub up theſe roots before they burn the turf, and others after, as beſt ſuits their convenience: but, in this laſt caſe, they certainly ſhould be dug up before the burning in thoſe places at leaſt where the furnaces are to be made, becauſe it is of great importance not to ſtir the heaps of aſhes produced by them, till the very inſtant of ſowing.

Before the ground is ſowed, the holes, made by the pulling up of great roots, ſhrubs, &c. ſhould be filled, ſo as to render the ſurface even. In countries where wood is ſcarce, theſe roots, ſtumps, &c. are carried away and dried for fuel, eſpecially for the kitchen; by which means they frequently repay at leaſt the expence of grubbing them up. But in places where wood is of ſo little value that theſe are not worth carrying off, the beſt way is to burn them with the turf, the aſhes of which they will both increaſe and improve.

* Mr. Worlidge rightly obſerves [a], that "the beſt and cheapeſt "method of grubbing up thorny ſhrubs, broom, goſs, or other "annoying growths, is ingeniouſly delivered by Gabriel Platt. "The inſtrument by him diſcovered is like a three-grained "dung-fork, but much larger and ſtronger, according to the "bigneſs of the ſhurbs, &c. The ſtale thereof like a large and "ſtrong lever. This inſtrument, being ſet half a foot, or ſuch "reaſonable diſtance from the root of the ſhurb, &c. and driven "in to a good depth with a ſtrong hedging beatle, then raiſed "by laying under it a ſtone or log of wood, is pulled down by "a rope faſtened to it's upper end, and wrenches up the whole "buſh by the roots."

[a] *p.* 24.

The

The thicker any land is covered with theſe wild productions, the better it will prove. If it coſts more than another to break up and bring into order, it will, in return, make ample amends, by producing greater crops.

The beſt time for paring off the ſurface of land, in order to burn it, and indeed the only ſeaſon in which it can be properly done in France, is, from the middle of March to within a few days of Midſummer, that is to ſay, during about three months, which, luckily, are not the huſbandman's moſt buſy time. It would not, as I ſaid before, be right to pare it earlier, becauſe the turfs would ſtrike freſh root; nor would later do ſo well, becauſe there would be danger of their not drying. Theſe three months, during which the ſun continues to aſcend with reſpect to us in this hemiſphere, are the ſeaſon in which the earth is drieſt, in proportion to the height of that luminary. After the turn of Midſummer, when the ſun becomes retrograde, the earth begins to emit a dampneſs, which increaſes with it's deſcent, and becomes at length ſo conſiderable, that it greatly retards, and ſometimes quite hinders, the drying of the turfs.

I ſhall not examine whether this moiſture be occaſioned by a ſpontaneous exſudation of the earth, or whether it proceeds from the air and the vapours which mix with it. The cauſe is here of leſs importance to us than the effect; it being eſſential in this kind of improvement, that the turfs dry well; to which end they are left in the poſition before mentioned. When the ſeaſon is not too wet, they generally dry ſufficiently in about three weeks, even without being turned: but in rainy years they require a longer time, and muſt often be turned again and again, leſt they ſhould ſtrike out new roots and ſhoots, which would hinder them from burning, as I have ſeen happen.

Theſe

Theſe turfs are eaſily turned by women and children. It appears from hence, that this method of clearing and breaking up ground is longeſt, moſt difficult, and moſt laborious, in rainy years; though theſe additional expences are not conſiderable.

About Midſummer, or rather a few days before, when the turfs are ſufficiently dry, a number of women and children ſhould be employed, in fine clear weather, but never in rain, to gather them all up, ſome with iron forks, and others with their hands, and pile them up, from ſpace to ſpace, in round heaps about ten feet high, and of the ſame width at bottom, almoſt in the ſhape of charcoal furnaces. The heathy ſide of the turf muſt here be placed downward, and the earthy ſide upward. A ſmall hollow muſt be left in the inſide, in order to form a kind of little chimney, the opening of which ſhould face the wind. I have ſaid that this work muſt not be ſet about in rainy weather; becauſe, if the heaps of turf ſhould unfortunately be ſo much wet as to imbibe the water, they would not burn, but muſt be pulled down, and ſpread anew, to dry as before. They might alſo, in this caſe, require very frequent turning, as has happened to me; which would retard the operation, and increaſe the expence: beſides which, even with that, it might not be poſſible to dry them ſufficiently before autumn, if the rains were frequent, whereby a conſiderable loſs would be occaſioned.

This laſt accident, though poſſible, is very rare. It never befel me; and upon inquiring of thoſe to whom it has happened, I found that it was in great meaſure owing to their own negligence. To avoid theſe inconveniences, the beſt way is to take the quickeſt advantage of the firſt fine weather, and if it appears at all uncertain, to ſet

more

more hands to work, without aiming at an ill-timed ſaving: for it is upon the due piling up and burning of the turfs (when properly cut and dried), that the whole ſucceſs of this important branch of huſbandry principally depends. It cannot be done too ſpeedily. When rain is apprehended, every other buſineſs ſhould be left for this, and all hands, men, women, and children, ſhould inſtantly be employed, to diſpatch it as ſoon as poſſible. Nothing requires greater diligence. The heaps ſhould be ſet on fire the moment they are made, or, even though the weather ſhould ſeem ſettled, before the huſbandman retires in the evening. Children may do this, by putting a little lighted ſtraw or heath, with the help of an iron fork, into the chimnies of the heaps. The dry heath, graſs, and roots, will catch inſtantly, and in a few moments the fire will become ſo violent, as ſcarcely to be approached. It may then be left, after having taken proper precautions to prevent it's extending farther than it ought; eſpecially if it be near any wood, hedge, or heath, where it might otherwiſe do great miſchief.

The misfortunes occaſioned by fire have been ſo numerous and dreadful, that too much care cannot be taken to guard againſt them. If the ſituation of the land which is to be burned be ſuch as gives the leaſt room to fear any danger of this kind, the furnaces ſhould not be lighted but in calm weather; for wind might ſoon ſpread the flames to neighbouring grounds, where it might not be poſſible to ſtop them till they had done irreparable damage.

If it be ſurrounded on all ſides with woods, heath, or other places eaſily ſet on fire, a row of furnaces ſhould, in this caſe, be made around the land intended to be burned, at the diſtance of twenty five or thirty feet from the neighbouring grounds,

grounds, and at leaſt ten feet from the other furnaces, which are afterwards to be built farther within this incloſure. Care ſhould then be taken to obſerve from which ſide the wind comes (for there will always be ſome wind even in the calmeſt weather), and the fire ſhould be ſet to the outer row of furnaces moſt under the wind. A number of men ſhould watch theſe furnaces while they burn, and ſhovel up earth upon them if they are ſo full of heath or other combuſtible matter as to occaſion too violent a flame.

The throwing on of this earth will deaden the flames, and concentrate the fire; by which means the furnaces will be conſumed by ſlow degrees, without hurting either the outer borders of the pared land, or it's inner parts, where this fire might do miſchief two ways; firſt, by ſpreading to, and burning, the yet unpiled turfs, the aſhes of which would ſoon looſe their virtue if ſcattered upon the earth in this looſe manner; and ſecondly, by catching the other furnaces, in caſe they ſhould be already made; for the fire would then become ſo great, that it would no longer be poſſible to ſtop it's progreſs, or prevent it's extending to the neighbouring grounds.

When the row of furnaces moſt under the wind is conſumed, the row next to that may be burnt in the ſame manner, and ſo on, till the whole work is done; only obſerving, for is is of conſequence, always to take the row moſt under the wind.

The morning is undoubtedly the moſt proper time for lighting all theſe furnaces, becauſe the people employed in this buſineſs have then the whole day before them, to watch the fire, and prevent accidents, which it might be very difficult to remedy in the night, particularly during the firſt violence of the flames. A number of proper per-

ſons, proportioned to the extent of the ground, ſhould remain upon the ſpot all night, as well to attend the burning of the turf, as to hinder wicked wretches from ſetting fire to other places, of which there have been two many inſtances.

By not neglecting any of theſe precautions, though all of them are not neceſſary where the fire cannot ſpread to adjacent grounds, every inconvenience may certainly be avoided.

I have often burnt in this manner pretty large tracts of my own land, hemmed in with woods, thick heath, and other combuſtible matters, and have not experienced the leaſt accident thereby. 'Tis true, I have ſuperintended the work myſelf: but this very circumſtance ſhews me, that thoſe who meet with misfortunes in it, certainly owe them to their own neglect.

If the furnaces are lighted in the evening, though, as I have juſt obſerved, the beginning of the day is a much fitter time, they muſt be let burn till the next morning, by which time the violence of the fire will be abated. A few men, or even women and children, ſhould then be ſent in among the heaps, with iron forks, to give them a little ſtirring, and lay upon them the turf which may have fallen off. Theſe furnaces will ſtill continue burning for ſome days, during which the turfs will be ſlowly conſumed or calcined. If any of them are ſituated on wet ſpots, where they will not burn, theſe women and children muſt mend them, and add freſh fuel, either dry heath, ſtubble, or even a little dry wood, with ſome of the burning turfs from the adjacent heaps. As ſoon as the fire is extinguiſhed in all the furnaces, which will then be reduced to heaps of aſhes, finer or coarſer in proportion to the goodneſs of the ſoil, the women and children muſt ſhovel them up into little round heaps, leſt they ſhould looſe their fer-

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tilizing quality, if left ſcattered abroad: for all our treaſure conſiſts in the ſalts contained in theſe little heaps, and the volatile parts of thoſe ſalts (which are the beſt) would ſoon fly off, if expoſed to the air. The dews at night, and the firſt rain which afterwards falls upon theſe heaps of aſhes, form on their ſurface a cruſt which hinders their being blown away by the wind, renders them impenetrable to the impreſſions of the air, and keeps in all their virtue: therefore the ſooner rain comes after this operation, the better it is. If any ſhould fall after the furnaces are thoroughly lighted, it would not hinder them from burning, unleſs it be very violent indeed, and of long continuance, which ſeldom happens at this ſeaſon *.

I muſt likewiſe obſerve on this occaſion, that when the ſurface of the land thus burnt is conſiderable, and the fire conſequently pretty ſtrong and extenſive, the clouds are often diſperſed thereby, if they are not very thick, and the weather is frequently rendered fair, in the ſame manner as is ſometimes effected by the exploſion of a number of cannon, in a battle, or at a ſiege. When the aſhes are thus laid up in little heaps, nothing more remains to be done to this ground till the time of ſowing: only care muſt be taken, that neither men nor cattle approach them ſo as to break their cruſt. The land will from this time be freed from all ſeeds of weeds, and other wild productions, as well as from all worms, inſects, reptiles, and venomous creatures; the action of the fire of the furnaces being ſo ſtrong, that it heats not only the

* The Swiſs huſbandmen are highly pleaſed when a moderate rain checks the violent burning of their furnaces. The calcination of the turf is then performed more ſlowly, and it's aſhes are thereby rendered greater in quantity and better in quality[a].

[a] *Memoires de la Societé de Berne, Tom.* I. *Par.*3. *p.* 634.

earth beneath them, to the depth of ſeveral inches, but likewiſe all the intermediate ſoil.

A fortnight after the uſual ſeed-time of the country, for wheat and rye, will be early enough to ſow this burnt ground. Our ſowing ſeaſon in Anjou is in October; ſo that this may be deferred there till even a few days after All-Saints *. When that is to be done, a number of women and children ſhould be ſent into the field, on a ſtill calm day, with wooden ſhovels, to ſpread the aſhes equally over all the ground, excepting the ſpots where the heaps were; for theſe are ſo thoroughly burnt that they want no farther manure, and are obſerved always to produce the fineſt corn. Some of theſe women and children ſhould likewiſe carry iron forks, to break and ſpread ſuch turfs as may not have been thoroughly conſumed; for theſe, being baked or calcined by the action of the fire, will be very beneficial to the land.

Immediately after this, the corn, be it wheat or rye, ſhould be ſowed over theſe aſhes by a ſkilful ſower, in not more than about half the quantity generally uſed for a ſimilar extent of other ground. The plowman ſhould follow the ſower, with his team, whether of horſes or of oxen, yoked to a plough of which the ſhare ſhould have two fins †, and which ſhould be ſtronger than that I recommended before for ſharp hungry ſands; though

* That is too late for this country; as will be ſhewn in the next chapter, where we ſhall treat of *Sowing*.

† The noble author of theſe excellent directions for breaking up and improving uncultivated lands, gives the following deſcription of this plough, in anſwer to a letter from the Berne Society, who had requeſted a farther explanation of it a.

"This plough, which is uſed in Anjou, and in ſeveral other provinces of France, where they plow their land in ridges, is

a *Memoires de la Societé de Berne, Tom.* I. *Par.* 4. *p.* 879.

not

though he ſhould not cut too deep this firſt year, but only make ſhallow furrows, going and returning, to cover the ſeed. Women and children, with hoes and iron forks, ſhould then be employed, carefully to break all the clods and every remain-

not neceſſary in countries where they plow either flat or into beds, and therefore is not known in Switzerland. It's ſize and ſtrength ſhould be proportioned to the depth and ſtiffneſs of the ſoil for which it is intended. In other reſpects, it's conſtruction is very ſimple. It has an iron ſhare with two fins, ſhaped as in *Fig.* 9. *Plate* III. and a longer or ſhorter, as well as broader and ſtronger, point; according to the nature of the ground in which it is uſed. Sometimes it has likewiſe an iron coulter, and at other times no coulter at all; which again depends on the quality of the ſoil: but generally, a ſtrong plate of iron, which helps to ſtrengthen the whole, is faſtened by a hook, with which one end of it terminates, in a hole near the middle of the ſock; whilſt it's other end, which is pierced with ſeveral holes, goes through a ſuitable mortiſe in the beam of the plough, where it is fixed either by an iron pin paſſed through a correſponding traverſe hole, or by wedges, which are eaſily driven in, or taken out. This plough, which is intended to turn the earth up on both ſides at once, has two mould-boards, made on purpoſe, ſomewhat concave all the way, but moſt ſo at the top, the better to turn over the earth. The thickneſs, length, and height of theſe mould boards, muſt be determined by the ſtrength of the plough, which is itſelf to be ſuited to the greater or leſs ſtiffneſs of the ſoil. The handle of this plough, and it's beam which reſts upon the axle-tree of the wheels, are like thoſe of other ploughs. This axle tree is of iron, run through a ſufficiently ſtrong piece of timber, in which notches are cut, or ſtout wooden pins are fixed, to ſhift the beam to the right or left as occaſion may require. The beam is faſtened to the fore-carriage by a ſtrong iron ring, through which it paſſes, at the end of a thick ſhort chain belonging to that fore part of the plough. Holes are bored through the beam, at proper diſtances, to receive a ſtrong iron pin with a large upright head, over which the ring is put, ſo as to ſecure the beam, and at the ſame time give it the neceſſary room to play.

The plough with only one fin to the ſhare, which is likewiſe uſed in Anjou and the neighbouring provinces, is made in the ſame manner; excepting, that it has but one mould-board, which is placed on the ſame ſide as the fin, namely, on the right.

ing bit of turf, and, finally, to cloſe the tops of the ridges, which the plough cannot do with the neceſſary exactneſs in this firſt plowing. If ſeveral ploughs work at the ſame time, as is generally the caſe with me, the number of women and children muſt be increaſed in proportion, and there muſt be a ſower before each plough.

It is very difficult to ſow theſe lands with only half the quantity of ſeed generally uſed in other places. The moſt dexterous are apt to miſtake; and I have experienced the bad effects of employing only one ſower for ſeveral ploughs. A man who goes before each of them, will ſow much more equally: nor need he even looſe any part of his time, becauſe, when he is not employed in ſowing, he may help the women and children to break the clods. The plowman ſhould always proceed ſlowly and cautiouſly in this firſt tillage, eſpecially if the ground ſeems never to have been plowed before. If his plough ſhould chance to be ſtopped by any ſtones or roots, (which may have eſcaped the endeavours uſed to diſcover them by means of my *Searcher*, which I always adviſe having recourſe to as ſoon as the ſurface of the ground is cleared), the other men within call, or even the women and children, muſt immediately take them up with crows and pick-axes, and throw them out of the field.

Care muſt be taken not to ſpread the aſhes out of the heaps over more ground than can be ſowed in the ſame day and the next morning, that they may not be needleſsly expoſed to the hazard of loſing their efficacy: but if it ſhould begin to rain, or the next day be a ſunday, no more aſhes ſhould be ſpread, than can be ſowed and plowed in directly. Theſe two circumſtances excepted, it will be right to ſpread over-night what is to be plowed in the next morning; for I have experienced,

rienced, that the little nipping froſts in this advanced ſeaſon will often be ſtrong enough to freze the aſhes and bits of turf not thoroughly conſumed, ſo as to render them un-fit for ſpreading, till the ſun has thawed them; by which means a morning's work might be loſt, without this precaution.

When the ſeed is ſown and covered, drains ſhould be cut with the ſame plough, either directly a-croſs the furrows, or a-ſlant them, according as the declivity of the ground may require, in ſuch manner that they may empty themſelves into the main ſurrounding ditches, to carry off the water, eſpecially in winter. Some of the men employed in breaking the clods will eaſily deepen theſe drains, to whatever degree may be requiſite, with an inſtrument ſhaped like a hoe, with a ſtrong flat iron ſpike, about fifteen or eighteen inches long, on each ſide of it. This inſtrument is very uſeful, and even neceſſary, upon ſeveral occaſions; nor is there any better for ſtirring the ground. It will likewiſe ſerve to complete the breaking up of ſuch parts of the ſpots where the furnaces ſtood, as may not have been cut ſufficiently by the plough; and to finiſh the imperfect ends of the furrows next the head-lands, where the plough could not reach in turning, and where the grain would otherwiſe be expoſed to the air and birds.

Though the ſpirit and warmth of the ſalts contained in the aſhes will ſoon render this corn more forward than any other; yet, as there will not be among it either graſs, weeds, or wild productions of any kind, the ſeeds of all theſe having been deſtroyed by the action of the fire, it will appear thin during part of the winter: but, on the approach of ſpring, it will ſhoot up, ſpread, and tiller, ſo as often to become too thick at laſt. It always ripens about a fornight ſooner than any other corn

in the country. The fineſt, as I ſaid before, is conſtantly found on the ſpots where the furnaces were; the effect of the fire having been greateſt, and penetrated deepeſt in thoſe places.

I muſt obſerve on this occaſion, that as all our riches here conſiſt in the aſhes, as was ſaid before, the more there is of them, the more the ground thus broken up will be fertilized. But all kinds of ſoils do not afford an equal quantity of aſhes, when burnt: for, though the burning be performed with ever ſo much care, repeated experience, for a long time paſt, has taught me, that only ſome of the earth and ſtones, according to their quality, is reduced into lime, or is calcined, by the operation of the fire, and that other parts of them will run to glaſs. The ſoils which calcine moſt, are undoubtedly the beſt, and yield the greateſt ſtore of aſhes; whilſt thoſe, on the contrary, which burn to a glaſſy ſubſtance, are the worſt, and produce the feweſt aſhes. Of this kind is ſand: and indeed one may judge with certainty of any ſoil intended to be improved in this manner, by firſt making this trial upon different parts of it. If the owner cannot go thither himſelf, he may order ſome of the turfs, cut with a depth of four or five inches of earth, to be brought to him, and may then dry and burn them. He may alſo have, in the ſame manner, in caps of paper, properly numbered, ſamples of the ſoil, or of the ſtones underneath, at every ſix inches from the ſurface, to the depth of eight or ten feet. Theſe ſamples may be eaſily got with the *Searcher* which I mentioned before.

If the perſon who would make theſe trials has not a ſearcher, holes muſt be dug. They will not coſt much, and he will be thereby enabled to judge what grain, trees, or other productions each ſoil is beſt adapted to. I have often practiſed this

method

method with ſucceſs, for improvements which lay at ſuch a diſtance that I could not immediately inſpect them myſelf: but as the judging of lands in this manner, without actually viſiting them, requires great attention and long practice, the ſureſt way for every body is to examine them on the ſpot, and there make the experiments. The furnaces which are the moſt burnt, or thoſe which burn the faſteſt, are not the beſt: for the aſhes there are conſumed too much, and their quantity is diminiſhed.

I have often ſeen much finer corn grow in places where the uppermoſt turfs of the heaps, which had burnt ſlowly, were only calcined, and remained ſo nearly intire, that it was neceſſary to break them before the ground could be ſowed; than in thoſe places where the furnaces, after being intirely burnt, were totally converted into aſhes. In general, thoſe heaps which produce white aſhes, after they are burnt, are the leaſt valuable, and commonly yield the ſmalleſt quantity. This denotes a greater degree of vitrification, than of calcination. In proportion as the aſhes are yellowiſh, brown, or blackiſh, which laſt indicates the greateſt imperfection, they are better in quality, and, generally, more in quantity. According to theſe different colours, the calcination exceeds the vitrification. I have dwelt the longer upon theſe different operations of fire in the burning of land, becauſe they are of great importance to thoſe who break up ground in this manner, and no writers have yet given a ſufficiently diſtinct account of them, for want of having had the neceſſary experience.

I muſt farther obſerve, that no land ought to be pared again too ſoon after it has been burnt; becauſe it's turf being deſtitute of a proper covering, would not take fire well, as I have experienced.

enced. It will be neceſſary to wait till the heath or broom has ſhot up ſufficiently, which ſeldom happens in leſs than about two years. The dangerous practice of ſome country people, who frequently ſet fire to their heaths in the ſpring, under pretence of bringing up graſs for their cattle, is ſo contrary to the right method of improving land, by burning it's pared ſurface, that it always retards, and ſometimes abſolutely prevents the executing of this far more beneficial method; eſpecially if thoſe burnings have been too often repeated.

In countries where it is not the cuſtom to plow in ridges, but either in broad lands, or quite flat, in order to ſow afterwards with the harrow, I think it would, however, be right, to ſow the ground thus broken up, at leaſt the firſt year, under furrow, with the two finned plough before mentioned; after which, the uſual method of the country may be followed, if it be thought the moſt proper. I adviſe this, as the beſt practice; and am ſatisfied that none will have cauſe to repent the trial. It will ſave the greateſt part of the expence of plowing; and the aſhes, being leſs expoſed to the air, will the more ſtrongly retain their fertilizing power. If, notwithſtanding theſe reaſons, the common practice of the country ſhould ſtill be preferred even in this firſt year; the huſbandman, in this caſe, ſhould begin to ſpread his aſhes, in the manner before directed, about Midſummmer, as ſoon as the furnaces are cooled, without leaving any in the places where thoſe furnaces were burnt. Immediately after, a ſlight plowing, juſt ſufficient to bury the aſhes, ſhould be given, with the precautions before mentioned in regard to the furrows. No more aſhes ſhould be ſpread at any one time, than the plow can cover in the ſame day. A few days after this firſt light

plowing,

plowing, a ſecond ſhould be given, ſomewhat deeper, in the ſame direction; and theſe plowings ſhould be continued, each going a little deeper than the former, till the ground be looſened to a ſufficient depth. Two good croſs-plowings will then be of excellent ſervice: after which, a fifth plowing, a-croſs them, will bring the furrows to the direction they were in at firſt. The ground ſhould be harrowed ſeveral times, between all theſe plowings, with harrows heavy in proportion to the ſtrength of the ſoil; and if any hard clods have reſiſted the force of the harrow, women and children ſhould be employed to break them, it being neceſſary to pulveriſe the ſoil as much as poſſible. I ſay, as much as poſſible; becauſe that work cannot be perfectly completed this firſt year.

The ſame women and children will likewiſe clear away all the ſtones, if there be occaſion. As each ſucceſſive plowing will turn the ſtones upon the ſurface, they need remove only ſuch as are bigger than a man's fiſt. Each woman and child ſhould be provided for this purpoſe with a baſket proportioned to their ſtrength. The weakeſt ſhould put the ſtones into the baſkets, and the ſtrongeſt ſhould carry them to heaps made from ſpace to ſpace, from whence they are afterwards to be conveyed in carts, to whatever place they are wanted at. If they are not wanted any where, they may be buried in holes made on purpoſe in the ground, and covered with a depth of earth ſufficient to allow a free paſſage to the plough. If any of the ſtones ſhould be too large for the women and children to carry, the carters will take them as they paſs by: and if there chance to be any under ground, ſo very big that the men cannot move or load them, they muſt be broke with ſledges and other iron tools fit for this work; or, if they are great rocks

rocks, they muſt be blown up with gun-powder: for nothing ſhould ſtop the progreſs of this undertaking. The ſame thing ſhould be done in thoſe lands that are ſowed under furrow, of which I ſpoke before.

The time to ſow the land thus broken up, this firſt year, will always be, for the reaſons I have aſſigned, a fortnight later than the common time of ſowing other land in the ſame country, with the ſame kind of grain. A few days before this is ſowed, it ſhould have another light plowing; after which it ſhould be ſowed, in proper weather, with half the uſual quantity of ſeed, whether wheat or rye, as was ſaid before, and this ſeed ſhould be covered in, either with the plough, if neceſſary, or with the harrow. Drains ſhould alſo be cut in this land, in the manner before directed, as ſoon as poſſible, to carry off the water in the winter. If any very large clods are left on the ground, women and children ſhould be employed to break them. This land being thus ſowed, nothing more need be done to it till harveſt.

As to thoſe little free-holders and farmers who who have but a few acres, which they chiefly till by dint of manual labour, with the pick-axe, ſpade, ſhovel, or other inſtrument; if after having pared and burnt a ſpot of new ground, they would likewiſe ſow it in either of the manners before directed, they muſt be particularly careful, when they dig it, to mix the aſhes thoroughly with the ſoil, and take away all the ſtones and roots. Theſe are the men who will have the greateſt crop of corn the firſt year, in proportion to the extent of their ground; for digging ſtirs the earth infinitely better than plowing. If all lands could be cultivated in that manner, their produce would be greatly increaſed.

I ſay nothing of the choice and preparation of the ſeed, becauſe thoſe matters are well known; but only recommend, that neither care nor coſt be ſpared in this reſpect.

The quality of the land muſt determine what ſort of grain will be moſt proper for the firſt year's ſowing in this huſbandry. If the ſoil be rich, it will bear wheat; if of a middling quality, it will produce meſlin, that is, a mixture of rye and wheat, conſiſting of a greater or leſs proportion of either of theſe, according to the nature of the ground; and, if it inclines to poorneſs, it will bring rye. Theſe things may be judged immediately after the burning. In general, unleſs the ſoil be very excellent, I would always adviſe ſowing rye the firſt year. There will be a certainty of ſucceſs with that grain; and the huſbandman will be enabled by it's produce, and by the plowings, to judge what his land may be capable of doing the next year, without running any hazard. This has been my method. I have likewiſe experienced, that rye commonly does much better than wheat, in all light ſandy ſoils thus broken up. When they are afterwards enriched to a certain degree, they become fit to bear meſlin, and then wheat; though, if they ſhould never produce any thing but rye, the difference would not be great in point of profit, as I have already obſerved.

I come now to the reaping of the ground broken up as before mentioned, and ſowed under furrow. This, for the reaſons I have aſſigned, may always be done about a fortnight earlier than for any other corn of the ſame kind, and in the ſame country, raiſed in the common way; a circumſtance which is attended with two advantages: firſt, that it affords the more time for plowing afterwards; and ſecondly, that it enables the huſbandman to find labourers, either to mow or reap

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it, with greater eaſe, and at leſs expence, than he could do at the end of that fortnight, when they will be fully employed. If there be danger of rain, it will be prudent to hire as many men as can be got, the ſooner to diſpatch the work; becauſe all corn is conſiderably damaged by being too much wet after it is cut down.

As ſoon as the ground is cleared, a light plowing ſhould be given, to bury the ſtubble; and ſome days after, it ſhould have a ſecond plowing, ſomewhat deeper, but in the ſame direction. When this is done, two good croſs plowings ſhould cut the ſoil to a proper depth for ſowing; and a fifth plowing, afterwards to be given, ſhould leave the furrows in their firſt direction. Between theſe five plowings, which are to be performed with the plough with one fin to the ſhare, and the precautions before mentioned in regard to ſtones and roots, the ground ſhould be well harrowed ſeveral times. All theſe plowings and harrowings will pulverize the earth, and mix it equally with the aſhes. If this land is to remain in ridges, this will be ſufficient until the ſixth plowing, which ſhould be given a few days before it is ſowed, and ſhould be followed by the laſt, performed with the two finned plough, to bury the ſeed: but if it is to be ſowed in broad-lands, or quite flat, my former directions in that reſpect are to be obſerved here. In whatever manner any of theſe new grounds broken up with the plough are ſown, they will not require near ſo many hands to break the clods this ſecond year, as were neceſſary in the firſt. With regard to the quantity of ſeed, a little more may be ſowed now, that is to ſay, about a third part leſs than is commonly uſed in the country, of the ſame kind of grain, for an equal extent of land.

As to thoſe ſmall ſpots which are dug, as they ſoon acquire, and retain for a long time, a greater degree of perfection than thoſe which are only plowed; it will be right to continue cultivating them in the ſame manner as at firſt, and to manure them from time to time; for I preſume they will not be planted with any thing but wheat, pulſe, or other productions of the deareſt kind, for which they are generally proper. It would be a pity to convert them into wood-land.

When I ſpoke of ſowing corn in newly broken up land cultivated with the plough, I did not direct the laying on of any manure becauſe, ſuch ground does not want it. If it ſhould afterwards be ſowed for a wood, which ought not to be done till it has been exhauſted by crops of corn, this impoveriſhment, far from hurting, will render it fitter for the growth of trees, than if their ſeeds had been ſown in it at firſt; a practice which I never ſhall adviſe. The earth is not then ſufficiently looſe; nor does it become ſo, but by the cultivation of corn continued for ſome years. During that time, this land ſhould be well plowed and harrowed, in order to get out of it as much as poſſible, either of wheat, meſlin, rye, or other grain. A barely middling ſoil will produce crops three years running, and better ground will hold out four or five years, and ſometimes longer.

The firſt crop will not be the beſt: on the contrary, it will often be but indifferent; the ground not being yet brought to a ſufficient tilth. However, it will always repay the greateſt part, if not the whole, of the expence of breaking up and cultivating the land. The ſecond will be much greater, and almoſt the whole of this will be clear gain. The third will alſo be good; and ſo will the following, if the ſoil be able to bear any more.

more. In the laſt year of plowing, cheſnuts, acorns, beech-maſt, or the ſeeds of other trees proper for the ſoil, may be ſowed with the corn; in which caſe care ſhould be taken, at harveſt, to cut this corn ſo high that there may be no danger of hurting the young plants.

If the land thus broken up, and afterwards tilled with the plough, be intended always to produce corn, and is not ſufficiently enriched by a great quantity of aſhes; I adviſe, in that caſe, to manure it the ſecond year, before it be ſowed in the manner above directed. It ſhould, however, have but a moderate dreſſing, that is to ſay, about as much as is commonly uſed for an equal quantity of other land. The compoſt which I mentioned before * will be of excellent ſervice here †. Experience will ſoon ſhew the benefit of manuring this ground the ſecond year, notwithſtanding the opinion of thoſe who pretend that new land is always rich enough of itſelf. There are very few ſoils which are not bettered by proper manure; and ſuch will be found to be ſingularly advantageous here, in the ſecond year, as I have repeatedly experienced on my own lands. Ever ſince I have

* *p.* 118.

† If burnt earth ſhould be thought abſolutely neceſſary, ſome part of the ſoil itſelf may, if there be plenty of wood or other fuel, be burnt and ſpread, as will be more particularly directed in treating of the *burning of Clay*. M. de Turbilly adviſes paring off and buring the turfy ſurface of neighbouring waſte grounds, in order to form *perpetual furnaces*, that is, furnaces of turf which burn continually, but ſlowly, till the heavy rains come on about the end of autumn. Theſe, if properly conſtructed, and ſupplied from time to time with a new addition of turfs, will, undoubtedly, yield a conſiderable quantity of aſhes, which may be raked away as they are formed, and be laid up in little heaps for future uſe. But I muſt beg the Marquis's pardon if I differ from him here, and think this a wrong practice; becauſe the ſtripping other places of their ſurface will render them barren, and unfit to be improved in their turn.

practiſed

practiſed this method, their fertility has increaſed conſiderably. My ſecond year's crop, of which I now ſpeak, is excellent, and that of the third equally good. For the fourth year, I lay on as much manure as the firſt time, and this procures me two more equally plentiful crops. Moſt of my burnt lands have been ſowed in this manner for five years running, and have yielded abundant crops, though the natural ſoil was but very indifferent. I have even ſowed ſome of them ſeveral years longer, and they have produced almoſt equally well, by manuring them every other year. The ſame ſucceſs will attend all ſuch as ſhall be treated in the ſame manner: but, in general, I think it will be beſt not to ſow them for above five years together, including the firſt crop, which, as I ſaid before, will be the worſt of all. At the end of this period, they ſhould be reſted a year, after which they may be treated like other arable grounds.

The lands thus brought into tillage by the means of burning, become infinitely better than other grounds, and produce much greater crops. This proceſs improves the ſoil for upwards of twenty years. No weeds will ſpring up among the corn for a conſiderable time; for there are ſcarcely any, even now, in the lands which I firſt broke up. The vegetable food in the earth is therefore not waſted here upon uſeleſs plants, but ſerves intirely to nouriſh the corn, which accordingly ſhoots with redoubled vigour, produces well filled ears, without the trouble or expence of weeding it, and, when threſhed, is ſo clean, that it needs only to be winnowed. The bread made of it is excellent, and of a ſuperior quality. When, in proceſs of time, theſe burnt-lands ſhall produce as many weeds as other plowed grounds, they will then be in the ſame degree of imperfection; but it will be a long while before that happens; even longer

than I can ſay, for I have not yet ſeen an inſtance of it. However, the remedy is always ſure and ready; by letting them reſt two or three years, by which time they will have acquired a new ſward thick enough to be pared off, and burnt as before. This will reſtore them to their former perfection, without being near ſo expenſive as the firſt paring and burning: for there will not be any roots to grub up here, or ſtones to carry off; nor will it be ſo difficult to break the now much fewer clods. I have managed in this manner, with great ſucceſs, where there has been a ſufficient depth of mould, lands which has formerly been in tillage, and would no longer produce corn, becauſe they were exhauſted, either by too many ſucceſſive crops, or too great quantities of weeds. They are now as good as any other burned land.

Worn-out meadows, which I have reſtored by the ſame means, and ſowed a-new with graſs ſeeds, have yielded great quantities of excellent hay. I had collected plenty of this ſeed, during ſome of the proceeding years, from meadows which were not too wet. Several of my neighbours have practiſed the ſame method, with equal ſucceſs: and in effect it is the moſt powerful of reſtoratives for worn-out land.

It evidently follows from what has been ſaid, that the paring and burning of the ſurface of the earth is, indiſputably, the beſt and ſureſt way either to clear or reſtore the ſoil. It is making a moſt advantageous acquiſition on one's own eſtate, the value of which is at leaſt doubled, often trebled, and ſometimes quadrupled, by this means. To enrich one's ſelf without doing it at the expence of any perſon whatever, and at the ſame time to enrich the ſtate, is ſurely an action worthy of a true patriot, and of a reſpectable father of a family. This may be done by following the

method here laid down; a method which was anciently known in Anjou, as well as in ſeveral other countries, though but very ſuperficially. I will venture to ſay, that it never was carried to the degree of perfection to which my practice has brought it; doubtleſs becauſe none applied themſelves particularly to it: nay, it had been ſo much neglected and diſuſed, that it was almoſt intirely forgot in my part of the country, when I began my improvements.

Good ſoils are, according to my diviſion, the third kind of uncultivated lands, of which I am to ſpeak. Under this head I comprehend all ſtrong, fat, clayey ſoils, and in general, all ſuch as ſtick to the feet when trod on. The breaking up of theſe will be ſomewhat more expenſive than that of poorer land; but, in return, their produce will be greater. Some of them are whitiſh, others yellowiſh, others reddiſh, others brown, and others again black. Their natural produce, the quantity of which is generally proportioned to their degree of goodneſs, as I obſerved before, is graſs, black and white thorn, brambles, junipers, heath, fern, furze, &c. Though this ſort of land is reputed the beſt, it often happens that ſome of it does not in reality equal the ſecond kind: but it has the advantage of being more commonly fit for wheat or meſlin.

When any of this land is to be broken up, care muſt be taken previouſly to free it from the three obſtacles before mentioned, namely, water, ſtones, and great roots. This ſhould be done in the winter. Afterwards it muſt be pared, in the manner, and at the time, before directed. If the weeds and other wild productions are but thinly ſcattered upon this ſoil, it's ſurface ſhould not be taken off ſo thick as is requiſite for other lands, leſt the turfs ſhould not burn, for want of a ſufficiency of

combuſtible matter: but if they have enough of that, which may be eaſily tried, they may be cut of the thickneſs before ſpecified.

As I have already particulariſed the other operations of this huſbandry by the means of burning, I ſhall not repeat them here. Wheat may be ſown the firſt year in ſuch places as are rich enough for that grain; and in others, where the ſoil is not ſo good, meſlin, with a greater or leſs proportion of wheat than of rye, according to the degree of goodneſs of the ground. This land is afterwards to be manured, plowed, and ſowed, during the ſame number of years, and in the ſame manner, as was explained before; obſerving the diſtinctions which I have made between ſuch grounds, cultivated in this manner, as are intended to be perpetually arable, and thoſe which are deſigned for wood: though I believe it will be but ſeldom, and from particular motives, that any of the ſoils I now ſpeak of will be ſet apart for the growth of timber. It will turn to much better account to ſow them with corn: for thoſe which would not produce even meſlin at firſt, will, in two or three years, be able to bring wheat unmixed with any other grain. Another conſiderable advantage attending theſe lands, is, that they calcine or turn moſtly to lime, when burnt: they likewiſe burn ſlower than thoſe of the ſecond kind, and afford a much greater quantity of aſhes; which, for the reaſons I have given, increaſes their fertility.

There are, however, ſome ſoils of this kind, which produce ſo few weeds or other wild productions, that it is not poſſible to take off ſods ſufficiently furniſhed with plants to make them burn. When ſuch lands are to be brought into tillage, inſtead of paring and burning them, they ſhould be dug and broken in the ſpring, with the

ſpade

ſpade and pick-axe, and be left to dry for a month or ſix weeks; after which, women and children, provided with iron and wooden rakes, may be employed to break the turfy clods, and ſhake the mould from off their roots. Theſe roots ſhould be well dried, while the ſun aſcends; then laid in heaps from ſpace to ſpace, where they are to be burnt; and their aſhes, after been ſpread with ſhovels, ſhould be plowed in as ſoon as poſſible with a one-finned plough. Several other plowings ſhould then be given ſucceſſively, during the heats of ſummer, with the ſame plough, croſs-wiſe, ſlanting, and in every other direction, in order to deſtroy the wild productions and pulverize the earth. Between theſe plowings, the women and children ſhould break all the clods in the manner before directed for the firſt kind of theſe lands.

The uſual ſeaſon for ſowing other lands, will alſo be the right time to ſow this, either under furrow with the two-finned plough, in broad-lands, or quite flat with the harrow, as may be judged beſt; but neither wheat, meſlin, or even rye, ſhould by any means be ſowed here the firſt year; for ground thus broken up, is not like that which has been pared and burnt: the operation of the fire, which this laſt undergoes, abſolutely deſtroys all the ſeeds of weeds and other wild productions, as well as all worms and inſects in it, and at the ſame time greatly corrects it's ſourneſs. The former, which has not been amended by the like operation, retains that ſourneſs, together with it's worms and inſects, and quantities of ſeeds of weeds; the conſequence of which is, that when it is ſowed with wheat, meſlin, or rye, thoſe worms grubs and inſects attack and devour the ſprouting corn.

In ſpring, the ſeeds of the weeds and other wild growth ſhoot up, rob the corn of it's beſt nouriſh-

ment, and almoſt intirely choak it. What remains, after having ſurmounted all theſe obſtacles, produces ſcarce any thing but ſtraw, with very little or no grain. I have made the trial, and find that oats are the fitteſt grain for the firſt year's ſowing of land thus broken up: they will ſtruggle through all theſe difficulties better than wheat or rye, and will have fuller ears. The crop, however, will not be very great; though it will be tolerably good. As ſoon as theſe oats are cut, the ground ſhould be plowed and croſs-plowed ſeveral ways and ſeveral times during the hot weather, in order to break and looſen it more and more, and to deſtroy the remaining roots of the weeds. It ſhould then be manured, either with common dung, or with the compoſts before mentioned; or, if there be occaſion, with marle, lime, or other ſubſtances of the like nature. If the ſoil ſhould be too ſtiff, grow abſolutely hard, and crack much in the heat of ſummer, ſand ſhould be laid on, to ſeparate it's too tenacious parts, and render it more looſe and fertile, as I have experienced it will do. When all theſe operations, or ſuch of them as are neceſſary, are peformed, this ground may be ſowed the ſecond year with wheat or meſlin, according to it's degree of goodneſs: the crop will prove ſatisfactory. The next, of the ſame grain, with which it may be ſowed again the following year, without any manure, will be ſtill greater. It ſhould then be reſted a year, and afterwards be put in the common courſe of tillage with other arable lands. This method of breaking up waſte land does not enrich the ſoil immediately, like paring off the ſurface and burning it.

The firſt crops are not near ſo conſiderable; and it will be a great while before this ground can be brought to a degree of fertility any thing like that which is given at once by burning: nor indeed

indeed it will ever acquire the ſame perfection. No pains or labour will ever totally deſtroy the weeds in this land, as I have experienced: conſequently the corn never is ſo clean and fine as on that which has been burnt. Though this way of bringing waſte ground into tillage is cheaper than paring and burning, I do not adviſe any one to practiſe it, if there be a poſſibility of uſing the other method.

I have indeed ſeen, in different parts of Germany and Switzerland, wood lands, thus grubbed up and brought into tillage, produce very abundant crops: nor did it ſurpriſe me; becauſe, wood being exceſſively cheap in thoſe countries, not only the ſtumps and roots, but alſo very many of the trees themſelves, had been dried and burnt upon the ground, and yielded a great quantity of aſhes. The ſoil, long before enriched by the leaves, was ſo thoroughly improved by theſe aſhes, that plants could not but proſper in it.

As to the breaking up of uncultivated land with the plough only, without having previouſly prepared it in one or other of the manners before directed, I do not by any means approve of that practice, unleſs it be for ſharp hungry ſands like thoſe of which I have ſpoken: for I have had great reaſon to be diſſatisfied with the trials I have made of it elſewhere. It cannot anſwer but in places where there no are weeds or wild plants, or at leaſt very few. The firſt plowing muſt be given at the end of winter or in the beginning of ſpring, while the ground is ſtill moiſt; for the drying winds in the ſpring would ſoon render it ſo hard, that the plough could not be able to penetrate ſufficiently deep. The ſecond plowing ſhould follow immediately, a-croſs the former, and theſe muſt be ſucceeded by ſeveral other plowings, in different directions, eſpecially during the ſummer

heats, in order to deſtroy the weeds, of which the roots muſt afterwards be raked together, laid in heaps, and burnt, as was before directed. Beſides the inconvenience of greatly harraſſing the cattle, and often breaking the plough, in this work; nothing but oats can be ſowed the firſt year, and they generally yield a bad crop; the ſoil ſtill retaining it's unkindly diſpoſition. The ſeeds of graſs and weeds ſhoot up, and the bringing of this ground to a good ſtate will be a work of many years and great labour. Thoſe who take this method, as the leaſt expenſive, will find in the end that they have not ſaved any thing, and often run the riſque of being loſers by it.

There are ſeveral other ways of breaking up uncultivated lands; but I do not mention them, becauſe they are inferior to the methods before directed. There may alſo be very good ones, with which I am not acquainted; for I am far from having exhauſted this very copious ſubject, in which I ſtill hope to make many uſeful diſcoveries.

I have not yet ſpoken of hedges, ditches, and young trees, becauſe it was neceſſary firſt to bring the land into a ſtate of culture. It is of great importance to incloſe the grounds which have been broken up, and if their extent be conſiderable, to divide them into fields ſurrounded with good ditches, upon the banks of which hedges ſhould be planted. Some fruit trees may be ſet in the inner parts of the incloſures; but this ſhould be done with caution, and at great diſtances; becauſe they would otherwiſe injure the corn, and be a hinderance to the plough. The great uſe of theſe hedges and ditches has been ſo thoroughly experienced, that I cannot recommend them too ſtrongly.

If the extent of the lands thus brought into tillage becomes very conſiderable, and there are

not dwelling houſes enough within proper diſtances, for the owners to let them at a ſuitable price; ſuch houſes ſhould be built by degrees, as the improvements are enlarged, and the ground ſhould be parcelled out in farms, rather ſmall than great; it being certain, that the more an eſtate is divided, the better it is cultivated, and the more it produces. The houſes may be built with the ſtones picked off from the very land thus improved; by which means every thing will be turned to profit. The expence of this will not be ſo great as ſome may think; for the firſt year's crops will, generally, more than pay it. I have tried this on my lands, and found it anſwer.

When marſhes are drained, the beſt method of improving them, whatever future productions they may be intended for, is, undoubtedly, to pare and burn them in the manner before directed. The operation of the fire, which they have greater need of than other lands, renders them amazingly fertile, as I have experienced.

All the methods which I have pointed out for breaking up uncultivated land and bringing it into tillage, may be practiſed in every part of the world; only obſerving the ſeaſons proper for each climate. I ſhall think myſelf very happy, and well rewarded for my pains, if theſe inſtructions prove of ſervice to mankind."

CHAP. III.

CHAP. III.

Of the culture of GRAIN AND PULSE,

according to the principles of the old and the new Huſbandry; with a comparative view of the advantages of each.

HAVING now given an account of the qualities of different ſoils, and of the nature and effects of different manures, ſo as to prepare the ground, in every reſpect, for plowing; directions for this laſt become of courſe my next neceſſary ſubject.

Here would I gladly fix, by the example of the wiſe and judicious Romans, the huſbandman's particular attention to this important article; by far the moſt eſſential of all the preparations which the earth undergoes. The ſententious Cato was thoroughly convinced of this truth, when he laid down as the firſt rule in huſbandry [a] to *plow well*; the ſecond, to *plow*; and the third, to *manure*: intimating by this, that plowing alone is of greater conſequence than all the other means of cultivating land. When the ground is well plowed, he adviſes to plow again; meaning, that it is not poſſible to plow too often or too much. The perfect culture of their lands was the ſolid foundation of the amazing ſucceſſes of thoſe once maſters of the world, who, as Pliny ſays [b], laid out their fields with the ſame judgment as they formed their camps, and attended to their crops with as much diligence as they did to the conqueſt

[a] *Cap.* LXI.. [b] *Lib.* XVIII. *c.* 3.

of

of the enemies of the ſtate. In the virtuous times of that great Republic, when labour and induſtry were juſtly valued and applauded, we ſcarcely hear of a famine at Rome, though they were every moment expoſed to have their corn and other fruits waſted by hoſtile incurſions [c]. The nobleſt and moſt numerous families in the Roman ſtate were then not only maintained by the produce of ſeven *jugera* (equal to about four and a half Engliſh acres), which was the fixed allowance of each, but the city was alſo plentifully ſupplied with proviſions. Another, and that a very great, advantage attending theſe ſmall farms, was, that this moderate diſtribution of land contributed immenſely to the increaſe of population: for this was the ſource which furniſhed thoſe victorious legions, whoſe conqueſts extended to the remoteſt parts of the globe.

The Romans were not only extremely attentive to the thorough culture of their land, but alſo, even in the latter times of the Republic, laid it down as a maxim to be followed by all good huſbandmen, "to ſow but little and plow much [d]". This is ſtrictly enjoined by Virgil [e]; and Pliny, who inſtances the huſbandry of Creſinus, which is the ſubject of the frontiſpice to this work, as an example of the good effects of this practice, laments the deplorable condition of Italy, when rich men, with the help of their numerous ſlaves, farmed large diſtricts of land; becauſe it diminiſhed the number of Roman citizens, and rendered the country leſs fruitful: for, as both he and Columella obſerve, the Romans then became dependant on other nations for the means of ſubſiſtance.

[c] COLUMELLA, *Lib.* I. *c.* 1. [d] PLIN. *Lib.* XVIII. *c.* 6.
[e] *Exiguum colito.*

May

Plowing

May not this naturally lead us to caſt an eye upon our own country, where, of late years, gentlemen throw their eſtates, as much as poſſible, into large farms, which, in the language of Mago the Carthaginian [f], muſt, in general, render the farm ſtronger than the farmer, whereby it neceſſarily becomes leſs fruitful? This practice is attended with another moſt fatal conſequence to a manufacturing and trading people: — it leſſens the number of inhabitants in the country, from whence only the ſupply of population ariſes; for cities and large towns are always an expence of men.

Whilſt I beſtow this due commendation on plowing, I do not mean to recommend it on Mr. Tull's principles, "that dividing and pulverizing the earth is all in all." — When the earth is in fine tilth, ſo that the roots of plants can eaſily extend themſelves every way, an advantage ariſes, which is thus deſcribed by the ingenious M. J. J. Biberg, in his Oeconony of Nature.

"Plants, as well as living creatures, muſt ſubmit to death. They ſpring up, they grow, they flouriſh, they ripen their fruit, they wither, and at laſt, having finiſhed their courſe, they die, and return again to the duſt, from whence they firſt took their riſe. Thus the black mould which we ſee upon the ſurface of the earth, is chiefly owing to dead vegetables. For all roots deſcend into the earth by their branches, and after a plant has loſt it's ſtem, the root remains; but this too rots at laſt, and changes into mould. By this means, this kind of mould is mixed with the earth, by the contrivance of nature; nearly in the ſame way as dung thrown upon fields is wrought into the earth by the induſtry of the huſbandman.

[f] COLUMELLA, *Lib.* I. *c.* 3.

The

The earth thus prepared offers again to plants from it's boſom, what it had received from them. For when ſeeds are committed to the earth, they draw to themſelves, accommodate to their nature, and turn into plants, the more ſubtile parts of this mould, by the co-operation of the ſun, air, and moiſture; ſo that the talleſt tree is, properly ſpeaking, nothing but mould wonderfully compounded and modified by a virtue communicated to a ſmall ſeed by the Creator. From theſe plants, when they die, juſt the ſame mould is formed, as gave birth to them originally; but in ſuch a manner, that it is in greater quantity than before, if the earth be kept looſe to admit of the free extenſion of the roots. Vegetables therefore increaſe the black mould; whence fertility remains continually un-interrupted: whereas the earth would not make good it's annual conſumption, if it were not conſtantly recruited by new ſupplies."

The illuſtrious M. Lullin de Chateauvieux, to whom the world in general is infinitely indebted for ſome of the moſt judicious and beſt executed experiments ever made in Agriculture, as is his native country in particular for his excellent adminiſtration in the high office of chief magiſtrate of the republic of Geneva, is the firſt writer who has attended to the advantages of ſtubble as a manure.

Towards the latter end of the year 1753, walking over his grounds after harveſt [g], he was ſtruck with the difference which he found in the ſtubble of his own experiments, and that of the corn which had been raiſed in the common way. This laſt was ſo poor and weak, that it ſcarcely oppoſed the motion of his feet, while the other reſiſted greatly. "I often felt it break, ſays he, under

[g] DUHAMEL, *Culture de Terres, Tom.* IV. *p.* 288.

my

my feet, and frequently met with tufts of twenty, thirty, forty, and ſometimes more ſtalks, which ſtopt me ſhort, like ſo many little buſhes. I am the more particular in my account of this ſtubble becauſe it ſhews the great ſtrength of the plants, which they would not have had if the earth had not been well prepared. Beſides, it has it's real uſe: for thorough plowing ſupplies the want of dung[h], not only by keeping the earth conſtantly in a looſe ſtate, but likewiſe by the quantity of ſtrong ſtubble which it produces, and which affords a moſt excellent manure attended with no expence. It lies ready upon the ſpot; the plowing of the earth buries it; and as it is a long time in rotting, it helps to keep the ſoil looſe and light, and is repeated every year. I have found ſtubble almoſt whole at a year's end, and have ſeen ſome not quite conſumed at the end of two years. From what I have ſeen of it's effects, I will venture to ſay, that it contributes greatly to increaſe the productions of the earth. I have very often plucked up plants remarkable for their beauty, and have frequently found their roots interwoven with tufts of ſtubble, which ſhewed me the cauſe of their extraordinary growth, of which I had an abſolutely indiſputable proof in the year 1755. All the ſtubble upon one of my beds cultivated according to the new huſbandry, was plucked up, by my direction, in order to ſatisfy myſelf in this point. When the ground was ſowed, and the corn ſprung up[i], I ordered the furrows which were made before winter, next to the outward rows, to be opened for about half the length of that bed, and the ſtubble to be put into them, and covered over with earth: conſequently it was laid in the ground which was cultivated, and in that part of

[h] *p.* 413. [i] *Tom. V. p.* 427.

it

it where the plants were to extend their roots. As the quantity of roots collected in that place was pretty great, I concluded that the effect ought to be much more viſible there, than it can be in fields where the plowman buries them as chance directs: nor was I miſtaken; for that part of the bed became much finer than the reſt, the plants produced a greater number of ſtalks, and every circumſtance demonſtrated beyond doubt, that the ſtubble was an excellent manure."

What is here obſerved of the ſtubble, may with equal truth be ſaid of the roots, which ſpread themſelves under the ſurface, through almoſt every interſtice of the mould, where, decaying gradually, they not only keep the particles of the earth aſunder, but, as they decay, become a real manure, already diſtributed in the moſt equal manner in the earth, as appeared by what M. Lullin obſerved[k] on opening a furrow near a row of corn, where he ſaw, in the whole length of the bed, the earth ſo completely furniſhed with a prodigious number of long roots, that they ſeemed in a manner interwoven with each other.

SECT. I.

Of Plowing.

PREVIOUS to any directions for the practical part of plowing, it will be proper to deſcribe three ploughs, which I think the beſt of any yet invented. It would be needleſs to ſpeak of thoſe which are moſt commonly uſed; becauſe they are already known, as well, perhaps, as they deſerve. The Rotheran, or patent plough, for the ſimplicity of it's make, and the eaſe and ſucceſs with

[k] *Tom.* IV. *p.* 296.

which

which it is worked, deſerves the huſbandman's particular attention.

Fig. 1. *Plate* IV, repreſents the left or land ſide of this plough, of which *AB* is the beam, *CD* the ſheath, *EBD* the main handle, *FR*, the ſmaller handle, *GH*, the coulter, *KI* the ſock or ſhare, *NP* the bridle, *S* the ſly-band, *ML* a piece of wood in place of a head. The forms of all theſe different parts, as they appear on this ſide of the plough, are here repreſented, and their ſizes and diſtances may be meaſured by the annexed ſcale of feet and inches.

Fig. 2, repreſents the right-hand ſide of this plough, with all the parts that can be ſeen on that ſide, in which *TV* is the mould-board, &c.

Fig. 3, ſhews the under part of this plough turned up, in which may be ſeen the ſhape and ſize of the ſhare, and the manner in which it is fixed on the ſheath, mould-board, and ground-reſt, with the angle which they make.

Fig. 4, repreſents the hind part of the plough, in which are ſeen the two handles *EF*, with the hinder part of the mould-board *VT*, and a piece of wood in the place of the head *LM*, in their proper ſhapes and ſizes by the ſcale.

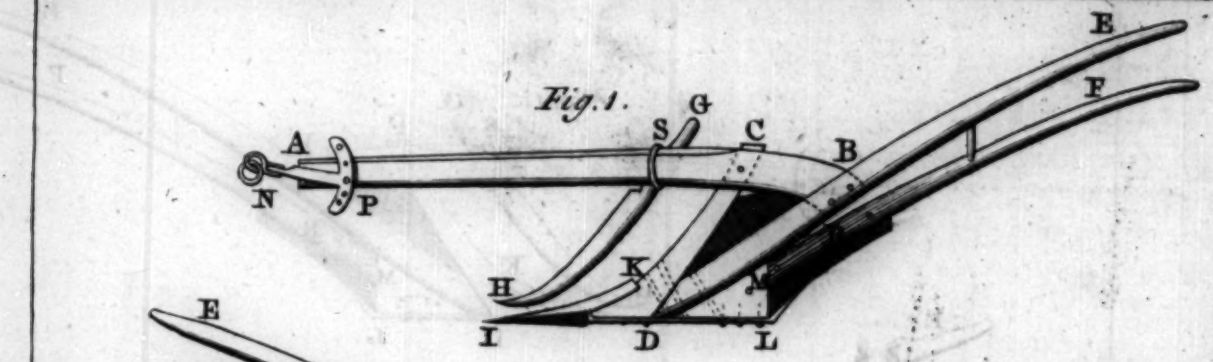
Fig. 5, repreſents an upper view of this plough, as it appears while it works, with the bridle *NP* extended, the mould-board *TV*, fixed in it's proper poſition, and all the other parts as they appear in this ſituation, in their ſeveral ſhapes and ſizes according to the ſcale.

Fig. 6, is the upper part of the ſock or ſhare.

Fig. 7, ſhews the opening of the ſhare, as it is fixed on the end of the ſheath and mould-board.

Fig. 8, is a perſpective view of the bridle.

The whole of this plough ſhould be made of aſh or elm; the irons ſhould be ſteeled and well tempered; and that part of the plough which is under-


Fig. 1.
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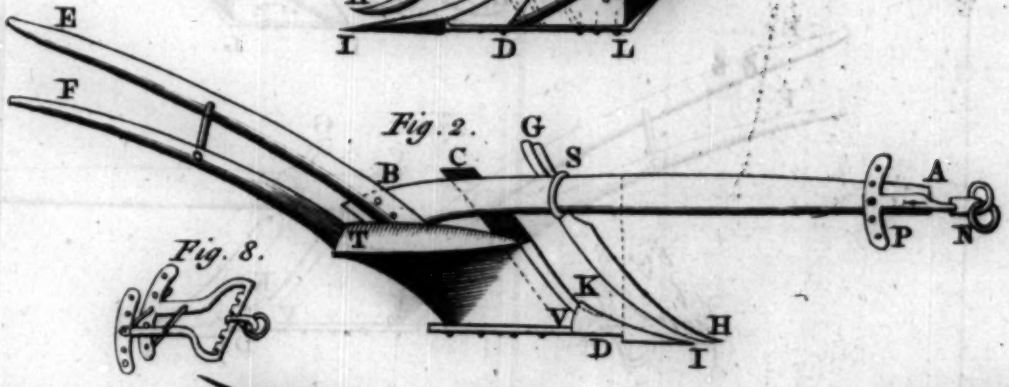

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Fig. 2.
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Fig. 8.

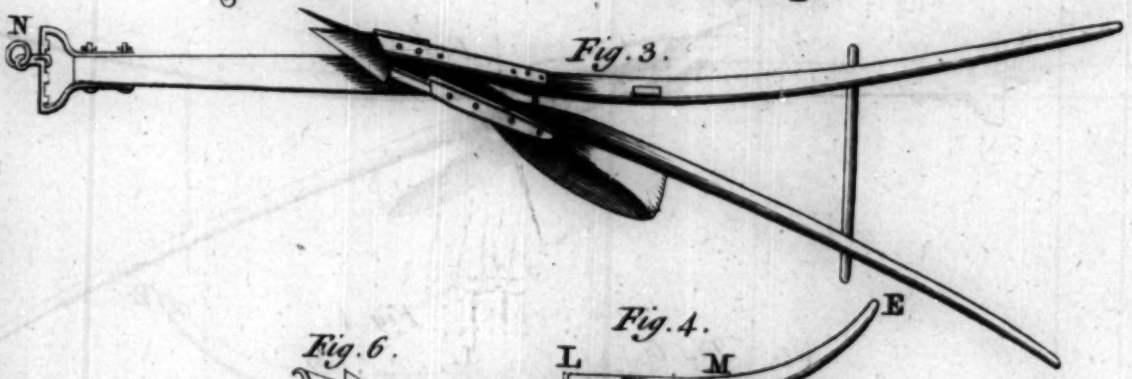
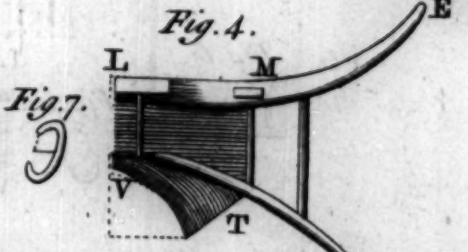
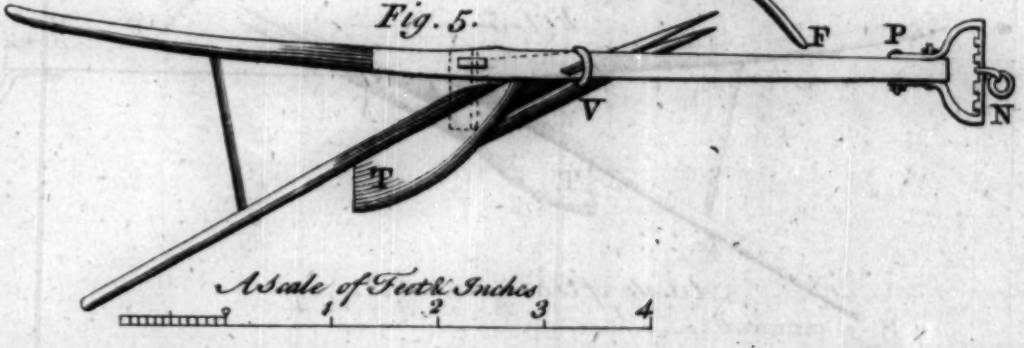
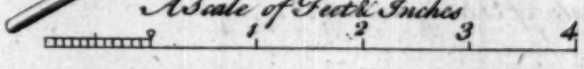

N
Fig. 3.

Fig. 6.


Fig. 4.
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M
Fig. 7.
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Fig. 5.
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A Scale of Feet & Inches
0
1
2
3
4

T. Goldar sc.

under ground in tilling, ſhould be covered with plates of iron.

The difference betwixt this and the common ploughs, ſeems to conſiſt in the bridle at the end of the beam, by which the plowman can give the plough more or leſs land by the notches at *N* in *Fig.* 3, and 5, or make it cut deeper or ſhallower by the holes at *P* in *Fig.* 1 and 2; in the coulter and ſhare, which are made and ſet ſo as to cut off the new furrow without tearing; and in the mould-broad, which is ſo ſhaped at firſt to raiſe a little, and then gradually turn over the new cut furrow with very little reſiſtance. But the greateſt advantage of all is, it's being ſo eaſy of draught, that it will do double the work of any common plough, as experience has proved; and, with only one man and two horſes, will perform, even in ſtiff land, as much as two men and ſix horſes can do in a moderately light ſoil with any of the wheeled ploughs generally uſed, or indeed known in this country, where their great defect is, that they are too complex, and weigh too much upon the fore-carriage, ſo that the friction of their wheels becomes a conſiderable addition to the draught: for the beſt plough certainly is that which is the moſt ſimple in it's make and tackle; which requires the leaſt ſtrength to draw it, in proportion to the ſtiffneſs of the ſoil; which can be made always to cut to a proper depth; and which, by the ſhape of it's mould-board, is beſt adabted to turn the furrow up-ſide down. The principle of the Kentiſh plough, with the ſhifting mould-board, is very good, where the land is dry and will admit of it.

Meſſieurs de Chateauvieux and Duhamel, ever ſtudious to promote the welfare of mankind, have endeavoured to remedy theſe inconveniencies in wheeled ploughs, by the following improvements,

which, with their uſual ſpirit of univerſal benevolence, they have, moſt obligingly, communicated to the world. I ſhall begin with the invention of the former of theſe gentlemen, becauſe it was rather prior, in point of time, to that of M. Duhamel.

The fore-part of M. de Chateauvieux's plough[k] is compoſed of a wheel 32 inches in diameter, which may be extended to 34 inches, or reduced to 30: but to fall ſhort of, or to exceed theſe meaſures, would be attended with inconveniencies. This wheel may be made very light, eſpecially if it be encircled with a thin hoop of iron. The plough itſelf is repreſented in *Plate* IV. *Fig.* 1, 2, and 3, where *Fig.* 2, is the plan, and *Fig.* 1, the profile.

The frame in which the wheel is placed, is formed by two ſhafts *AB*, *CD*, *Fig.* 2, diſtant from each other 18 inches, from inſide to inſide; which fixes the length of the nave of the wheel. Theſe ſhafts are four feet eight inches long, and may be reduced to four feet four inches, by ſhortening them at the ends *C* and *A*. They are about two inches and a quarter ſquare: but the edges ſhould be rounded off. Theſe two pieces are faſtened together by the two croſs ſtaves *EF*, *GH*, which are two inches and a half wide, and about an inch thick. They are riveted to one of the ſhafts, at *E* and *G*, where they are not to be looſened at all; and at their other ends *F* and *H*, the ſhaft muſt be moveable, ſo as to be taken off, to let the two croſs ſtaves through two mortiſes in the beam *IK* of the plough; after which the ſhaft *CD* is put in it's place, and fixed with two iron pins, *a*, *b*. Between the two ſhafts is placed the wheel *LM*, the nave of which is pierced through it's center,

[k] DUHAMEL, *Culture des Terres*, *Tom.* II. *p.* 402.

with

with a hole proportioned to the thickneſs of the iron pin or ſpindle *NO*, which ſerves for an axle tree, and is repreſented by the two pricked lines. This ſpindle, or axle tree, the diameter of which is about three quarters of an inch, ought not to project beyond the outſide of the ſhafts, leſt it ſhould lay hold of or hurt the ſtalks of the corn, when this plough is uſed for ſtirring the earth between the rows in the new huſbandry, as will hereafter be more particularly mentioned. To fix it at *N*, that end is flattened, and bent over the ſhaft to the middle of it's upper ſide, where it is faſtened at *d*, by a ſmall pin driven through it and the ſhaft.

On the upper ſurface of each of the ſhafts, at the ends *A* and *C*, are the hooks *A C*, to which the harneſs is faſtened: and at the other ends *B* and *D*, are two rings, the uſe of which will be explained hereafter.

The ſhafts *AB*, *CD*, ſhould be pierced with four or five holes, to ſet the wheel more or leſs forward or backward, in order to make the plough ſtrike more or leſs deep into the earth, as may be ſeen in *Fig.* 1. at *a*, *b*, *c*, and *d*. The ſame holes are indicated by the pricked lines on the two ſhafts of *Fig.* 2. from *A* to *N*, and from *C* to *O*.

The hind part of this plough conſiſts of the beam *IK*, *Fig.* 1. and 2; the ground-reſt *CD Fig.* 1, which is covered by the ſhare *LD*; the handles *KP*, *KQ Fig.* 2, and *KP Fig.* 1; the ſheat *EF. Fig.* 1, of which part is pricked in *Fig.* 1, and the end appears at *X* in *Fig.* 2; the mould-board *RS Fig.* 2, part of which is ſeen at *N* in *Fig.* 1; the coulter *GH Fig.* 1, and *TV Fig.* 2, and the ſhare *LD Fig.* 1, part of which is ſeen at *Y* in *Fig.* 2.

The beam is four feet eight inches long, excluſive of the tenon which traverſes the handles. Three inches and a quarter ſquare are very ſuffi-

cient it it's thickeſt part, which is from *X* to *V*, *Fig.* 2. The mortiſes in the beam, which are under *g*, *h*, and through which the two croſs ſtaves, *EF*, *GH*, are ſlipt, ſhould be ſo fitted, that the croſs ſtaves may not ſhake or be looſe in them, at the ſame time that the beam ſhould, by their help, ſlip with eaſe over the croſs ſtaves, either to the right towards *EG*, or to the left towards *FH*, according as the intended plowing may require. The beam ſhould be faſtened, either by two nuts ſcrewed on at *m n*, which will fix it tight to the croſs ſtaves *EF*, *GH*; or by two iron pins ſtuck through the holes *p* and *q* in the two croſs ſtaves, one to the right in the croſs ſtaff *EF*, and the other to the left in the croſs ſtaff *GH*. Theſe pins will keep the beam ſteady in it's place.

The lower part of the ground-reſt ſhould be ſomewhat concave, as is repreſented at *CD*, *Fig.* 4, in order to leſſen it's friction againſt the earth.

The beam *IK*, *Fig.* 1, and the ground-reſt *CD*, are faſtened together by the ſheat *FE*, and the handles *PK*, both of which laſt are riveted to the ground-reſt by two ſtrong iron pins, the heads of which are ſeen at *g* and *h*; and to the beam, as alſo to the tenon of the beam which traverſes the handles at *m*, *n*; and by the two wedges, *p*, *o* and *q*, another uſe of which will be explained hereafter.

Wood naturally crooked is beſt to make the handles of, that they may be all of one piece, which ſhould be ſo diſpoſed, that one third of the ſpace between the two handles, ſhould be left on the left ſide, and the two other thirds on the right ſide, in order to facilitate the plowman's walking in the furrow. This diſpoſition is ſhewed in *Fig.* 2. in which a line *e*, *f*, drawn from the middle of the beam, between the two handles, gives to the left ſide a third *Pf*, of the diſtance *PQ* between the

two handles, and the two other thirds *fQ* to the other ſide.

For want of wood naturally bent to a proper ſhape, theſe handles may be made of two pieces firmly riveted and faſtened together; and if it ſhould be more convenient to the plowman, the whole ſpace between the handles may be on the right ſide, as in *Fig.* 6.

The ſheat *EF Fig.* 1, ſhould be very ſtrongly and cloſely faſtened by it's tenon to the ground-reſt, at *g*. An intelligent workman will eaſily make it of a proper ſize, which is about two inches and a half wide, and a full inch thick. The inclining of this piece with the ground-reſt, gives it greater ſtrength to reſiſt, than if it was faſtened to it at right angles.

The mould-board, repreſented by *RS*, *Fig.* 2, and *AB*, *Fig.* 7, is from 30 to 31 inches long, and ten inches high or deep. It ought to be placed as in *Fig.* 8, where it's end *A* forms an acute angle, terminating at the junction of the fin of the ſhare: it's other end *B* extends beyond the length of the ground-reſt, againſt which it ſhould incline, in ſuch manner that, ſuppoſing the ground-reſt to be lengthened out as far as *C*, the line *CB* would be twelve or thirteen inches long, reckoning from the fartheſt lateral ſurface of the ground-reſt to the fartheſt lateral ſurface of the mould-board, which, being thus placed, will form the width of the furrow.

The lower part of this mould-board is ſloped a little inward, as is expreſſed by the ſhade in *Fig.* 7: and the part *b Fig.* 7, ſhould jet out at leaſt two inches beyond the part *a*. To this end, the mould-board ſhould be made of a plank about three inches thick, which will bear being ſcooped on one ſide and rounded off on the other, in order

to give it the concavity without, and the convexity within, repreſented in *Fig.* 3. and 7.

The mould-board ſhould be well faſtened, to prevent it's being diſplaced by the reſiſtance of the earth. The upright piece *CD Fig.* 7, which joins to the handles at it's end *D*, and to the mould-board at it's other end *C*, ſupports it ſtrongly. It is highly neceſſary to cover the part of the mould-board which bears upon the earth, with a thin plate of iron, in order to preſerve it; for otherwiſe it would ſoon be worn out.

The coulter *GH*, *Fig.* 1. ſhould be made of good iron well ſteeled. A notch is cut in the beam to receive it, as in *Fig.* 9 and 10; and as the corners of that notch, *C* and *B*, againſt which the coulter bears hardeſt when the plough works, would ſoon be worn away if the wood was left bare, it is proper to ſecure them with two ſmall pieces of iron *AB*, *CD*, about the ſixth part of an inch in thickneſs, ſcrewed on with flat-headed ſcrews. Theſe pieces of iron will keep the coulter ſteady in it's place.

The coulter ſhould be pierced with ſeveral holes, from *E* to *F*, *Fig.* 10, to take it higher up, or let it lower down, as occaſion may require. It is faſtened to the beam, which is pierced at *E*, *Fig.* 9, by a ſtrong iron pin with a ſquare flat head, which is let into the beam and lies even with it, as in *Fig.* 10. The other end of this pin, *E*, *Fig*, 10, is a ſcrew, fitted with it's nut, by which the coulter is faſtened tight to the beam. Upon this ſcrew hangs the handle *A Fig.* 1, which ſerves to turn it, and at the end of which is the key that faſtens on the nuts of the iron pins which ſecure the ſhare. By this means, the key to turn the ſcrews is always carried with the plough.

M. de Chateauvieux's coulters weigh but five or ſix pounds a-piece at moſt, and frequently not more than three pounds.

He places his coulter ſo that it's point *G*, *Fig.* 1. projects about an inch beyond the outſide of the ſhare *LC*.

Fig. 12 repreſents the ſhape of the ſhare, with it's dimenſions, as do alſo *Fig.* 13. and 14. The point of this ſhould be made of good ſteel, and the reſt of good iron, neither too ſoft, nor too high tempered, that it may not be ſubject to break or bend. The tail of the ſhare, *AB*, *Fig.* 12, ſhould be thickeſt from *A* to *C*, becauſe that is the part which bears the greateſt ſtreſs. It's thickneſs diminiſhes gradually to *B*, where the ſhare is faſtened to the ground-reſt. This tail is pierced with two round holes at *A* and *B*, *Fig.* 13, through which are put the iron pins *DE*, *FG*, *Fig.* 12. which have ſquare flat heads, lying even with the tail of the ſhare. Theſe pins paſs through the ground-reſt, where they are faſtened on the other ſide by the nuts *E G*. A third round hole may be added at *x* *Fig.* 13, in order to faſten the ſhare ſtill more firmly to the ground-reſt, with a ſhort flat headed ſcrew.

M. de Chateauvieux has likewiſe made ſome ploughs with the round holes *a b* *Fig.* 13, near *A* and *B*; that the iron pins *D E*, *FG*, *Fig.* 12, might not traverſe the tenons of the ſheat and handles; and inſtead of thoſe iron pins, he has riveted them with wooden pins, and found them keep the whole tighter together than the iron ones.

To the left ſide of the plough ſhould be faſtened the thin board *N*, *Fig.* 1 and 7, the uſe of which is to prevent the earth from tumbling over between the ſhare and the mould-board. As plowing wears the point of the ſhare, though it will

not hurt this ſo much as it does that of the common plough, it muſt be new pointed from time to time, always obſerving to make the point incline a little towards the earth, as is repreſented by the pricked line *D L*, *Fig.* 1; that the ſhare may ſcarcely touch the ground at any other part than *D* and *L*, in order to leſſen the friction.

The hind part of the plough, thus formed, is joined to the fore carriage, by running the croſs ſtaves *E F*, *G H*, *Fig.* 2. through the mortiſes of the beams, *g h*; and is fixed there, either by the ſcrews *m n*, or the pins *p*, *q*. The traces of the firſt and ſecond horſe are faſtened to the hooks *A C*; and if a third horſe be uſed, the traces of that third horſe are faſtened to thoſe of the ſecond. Horſes will do better for this plough, than oxen, unleſs theſe laſt have been uſed to be harneſſed one before the other.

The plough thus equipped, may eaſily be carried to the field, if it's hind part is laid upon the little carriage *Æ W*, *Fig.* 2. conſiſting of an iron axle tree *Æ W*, two ſmall wheels *k i*, *l r*, and the two pieces *B t*, *D v*, at the end of which are the hooks *B* and *D*. Theſe wheels are about 21 inches or two feet in diameter, and three feet ſix inches, or even four feet aſunder. They are very light, having but a ſmall weight to bear. The hooks of theſe two pieces *B t*, *D v*, are inſerted in the rings *B* and *D* at the end of the ſhafts; and by this means the plough will be carried upon three wheels, of which *Fig.* 1 and 2 ſhew ſufficiently the arrangement and uſe. *Fig.* 5, ſhews the ſlope that ſhould be given to the upper ſurface of the middle of the axle tree of this ſmall carriage, on which the reſt of the plough is to be loaded in order to remove it from one place to another, that the ground-reſt and other pieces may lie flat and ſteady upon it.

To

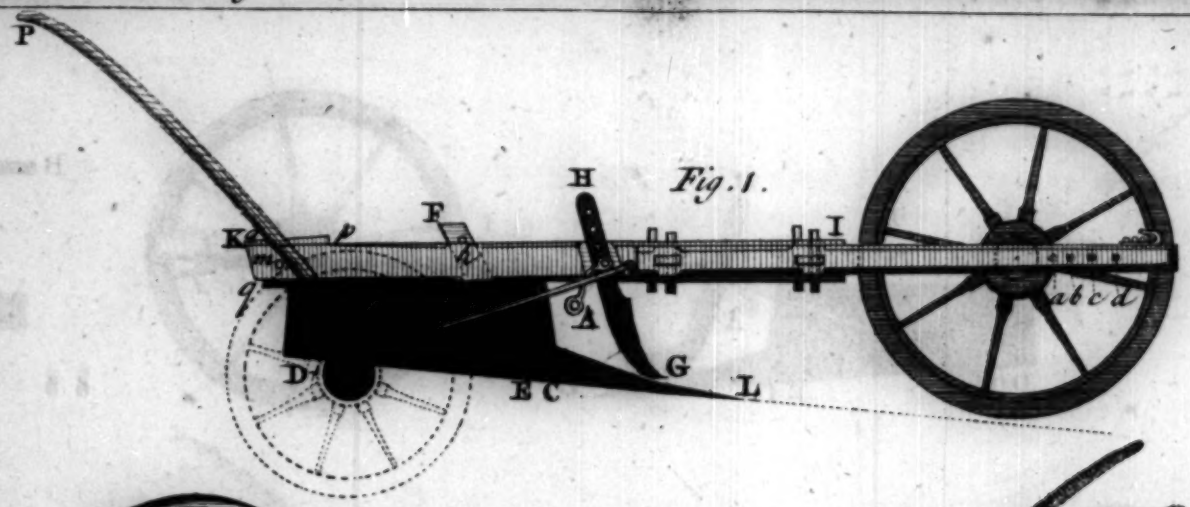


Fig. 1.



Fig. 12.


Fig. 13.

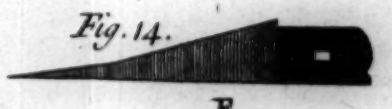

Fig. 14.



Fig. 11.



Fig. 10.



Fig. 9.

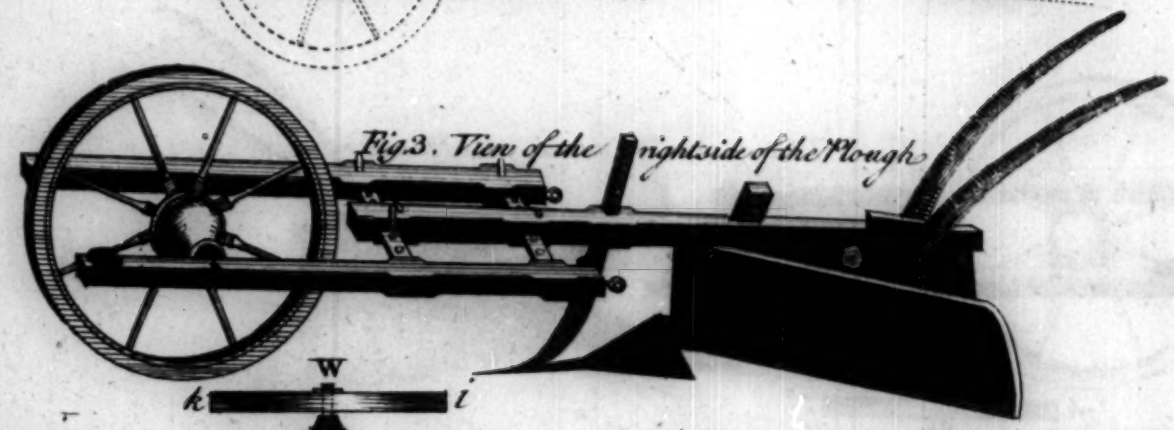


Fig. 3. View of the nightside of the Plough

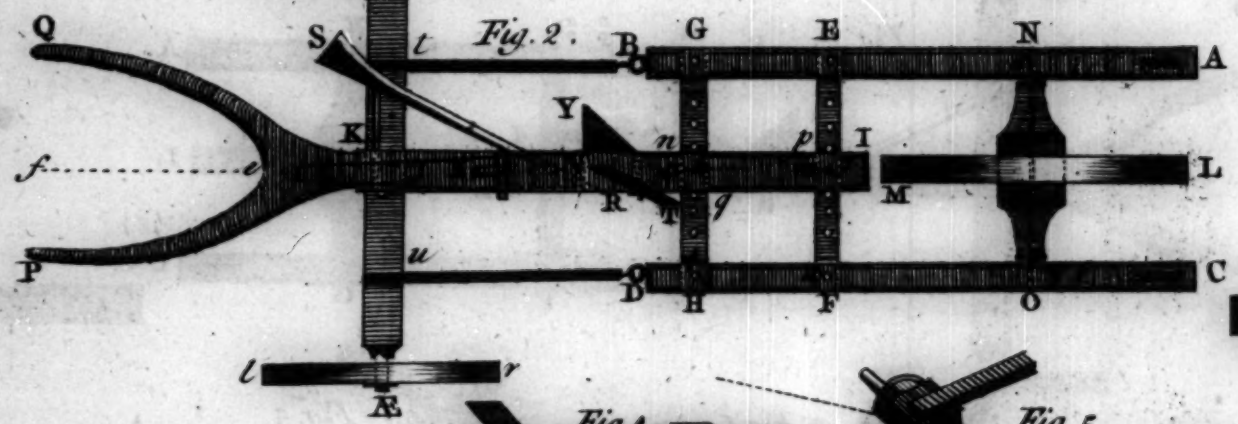


Fig. 2.

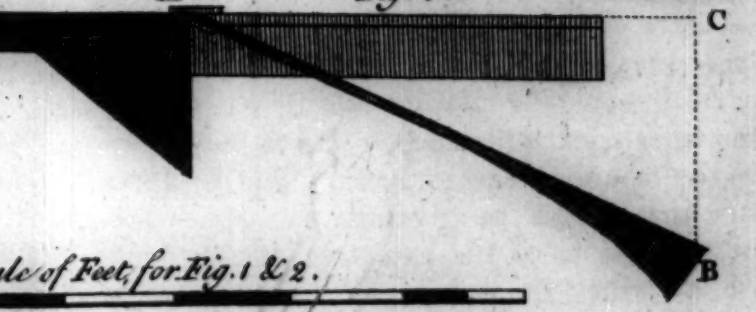


Fig. 8.

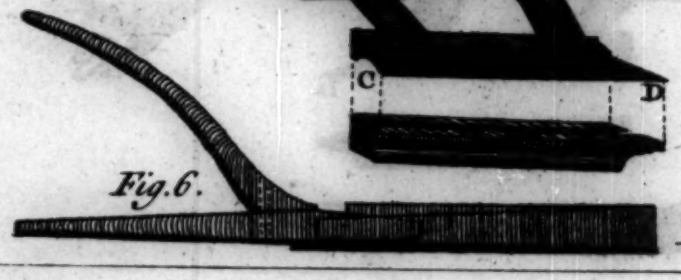


Fig. 4.

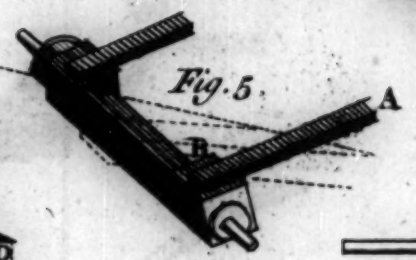


Fig. 5.

Fig. 6.



Fig. 7.

Scale of Feet, for Fig. 1 & 2.

Scale of Feet, for Fig. 8. 12. 13. & 14.

J. Goldar Sc.

To open the firſt furrow with this plough, the wheel muſt be placed at the laſt hole, towards the extremity of the ſhafts. This makes the ſhare incline the more, and conſequently cut the deeper. But as it would be ſomewhat troubleſome to change the poſition of the wheel, at every firſt cut of the plough, a very little attention will remedy that inconvenience. It is only inclining the handlesof the plough to the right or left, inſtead of holding them even. The whole plough will incline with the handles, and the ſhare will then enter into the ground with eaſe, and open the firſt furrow. The other furrows are plowed without any ſort of difficulty; and for them, the plough is to be held even, or inclined but very little, either to the right hand or the left, as the ſituation of the land may require.

M. de Chateavieux generally reſts the beam on the left hand ſide of the fore-carriage. It is eaſy to place it ſo as to leave whatever diſtance is thought proper between the outmoſt row of corn and the furrow that is actually plowing.

The forwarder the wheel is ſet, the deeper the plough cuts; and ſo on the contrary. But if one would have it cut ſtill deeper, or ſhallower, than it can be made to do by altering the poſition of the wheel, that too may eaſily be effected. By looſening a little the wedge above the beam, *p*, *o*, *Fig.* 1. and driving farther in the wedge *q*, the plough will cut leſs deep: as, on the other hand, the ſhare will be more inclined, and therefore cut deeper, if the wedge *q* under the beam is looſened, and the wedge *p*, *o*, over it is driven in tighter.

The chief differences between M. de Chateauvieux's plough, and that of M. Duhamel, are as follow.

1. The beam of this laſt, *ABC*, *Fig.* 1. *Plate* V. bends from *C* to *B*; whereas that of M. de Chateauvieux's is nearly ſtrait all along.

2. In

2. In conſequence of this bending, the hindmoſt extremity of M. Duhamel's beam is joined at *B* to the hindermoſt part of the ground-reſt *E*, after paſſing through a mortiſe *F*, in the lower part of the handles: ſo that this beam is joined to the ground-reſt by it's extremity *B*, the bottoms of the handles *F*, and the ſheat *G*; whilſt that of M. de Chateauvieux's plough, is joined to the ground-reſt by this ſheat, another which this plough has not, and the lower part of the handles: for the beam does not anſwer to the ground-reſt.

3. The mould-board *HI*, *Fig.* 2, of this plough, is lighter than that of M. de Chateauvieux's, and differently ſhaped.

4. The two handles *KK*, are at equal diſtances from the beam, and are joined together by a croſs ſtaff *M*.

5. The ſhare *N*, *Fig.* 3, is pretty much like that of M. de Chateauvieux's plough, but ſhorter and narrower; ſo that it cuts leſs wide furrows, which M. Duhamel rightly thinks the beſt way of plowing.

6. The coulter *O* of this plough paſſes through a mortiſe in the beam, which is there ſtrengthened by hoops of iron, to prevent the beam's being ſplit by the driving in of the wedges *PP* which fix the coulter.

M. Duhamel thinks this hind part of his plough preferable to that of M. de Chateauvieux's, for light lands: but it would not do ſo well in ſtiff ſoils, becauſe the earth would be apt to clog about the ſheat at *Q*; whereas it is thrown off by M. de Chateauvieux's plough. M. Duhamel likewiſe approves of making the beam ſtrait as M. de Chateauvieux's is, inſtead of giving it the bending from *C* to *B*, eſpecially for ſtiff lands.

7. The beam *C A*, is fixed to the croſs ſtaves *RR* of the fore-carriage of this plough, by the ſcrews and nuts *SS*.

8. The

8. The ſhafts *TT*, are faſtened before by a croſs ſtaff *V*, which gives great ſolidity to the fore-carriage, and cannot be added to M. de Chateauvieux s plough; not only becauſe the wheel is too large, but likewiſe becauſe it muſt be ſet forwarder or backwarder, in order to make the ſhare cut more or leſs deep.

The wheel of this plough is not ſo large as that of M. de Chateauvieux's, becauſe the axle-tree, inſtead of being inſerted in the ſhafts *TT*, is let into the ſide pieces *X*, *Fig.* 4, which are faſtened to the ſhafts by the ſcrews and nuts *YY*.

The advantages of having the wheel ſmaller, are, 1. That the plough is leſs apt to lean too much on it's ſide, and is more eaſily held upright; 2. That the croſs ſtaff *V* may be added to the fore-carriage, by which it is rendered more ſolid; and 3. That the fore-carriage may be made ſhorter than it otherwiſe could be.

The bare inſpection of the draught of this plough, ſhews that it is made to cut more or leſs deep, by ſcrewing the nuts *Y* more or leſs tight, and putting a thicker or thinner wedge between the ſide piece *X* and the ſhaft; which is an eaſier and quicker way, than changing the ſituation of the wheel. But ſtill, a readier method is, to have under the ſhafts *TT*, a falſe ſhaft *ZZ*, *Fig.* 5, fixed with hinges, &c.: for then, by only ſticking the peg *a*, into one of the holes *b*, the beam is raiſed or lowered, in a moment, to whatever degree is thought proper, without altering the poſition of the wheel.

It is likewiſe evident, that in order to give the ſhare a greater or leſs degree of entrance into the earth, nothing more is requiſite than to place the beam nearer to, or farther from, the right hand ſhaft: for the horſes, which are harneſſed one before another, go, as does alſo the wheel, in the

laſt

laſt made furrow, and the plowman goes in the furrow actually making.

d d. Are hooks to faſten on the harneſs of the horſes.

e e. Cramps to faſten the fore-carriage.

f f. Pins to fix the beam to the ſheat.

g g. Pegs to faſten the croſs ſtaves.

h. A ſtrong pin which goes through the hole *i*, to keep the mould-board ſteady.

After this deſcription of theſe ploughs, the great importance of the ſubject requires my ſpeaking yet more fully of the advantages of preſerving land in the fineſt tilth; in ſupport of which fact I cannot call in better evidence than that of M. Lullin de Chateauvieux, who, after repeated experiments, performed with the utmoſt accuracy and judgment, and ſtill purſued with a care and attention peculiar to himſelf, declares, that huſbandmen cannot too ſeriouſly conſider the great principle on which the due culture of the earth is founded, *viz. thoroughly to divide and looſen the ſoil.* "This principle, ſays he [a], is ſo generally received, that there is not a farmer who does not know, that one plowing more than ordinary is of as much ſervice to his ground as dunging it would be. Experience muſt certainly have ſhewed him that his crops are bettered by this extraordinary plowing: but he is not ſufficiently ſenſible, that, of all the ways of improving his land, no one is more effectual, or leſs expenſive than this. If it's full value were known, it would be practiſed more, and every huſbandman would give all his lands at leaſt one plowing extraordinary."

"To ſatisfy myſelf of what might be done with the plough alone, continues that excellent cultivator [b], I reſolved to make a trial on a ſpot

a DUHAMEL, *Culture des Terres, Tom.* IV, *p.* 301.
b *Ibid. p.* 355.

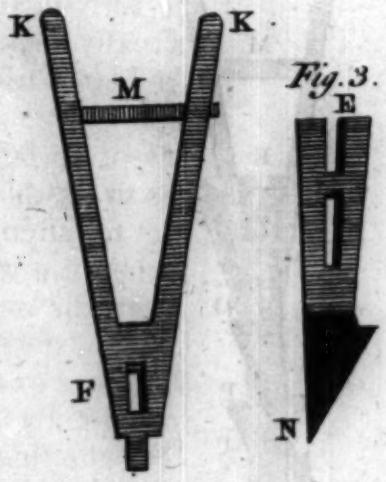


Fig. 3.

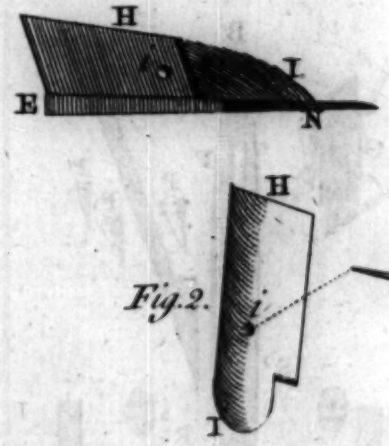


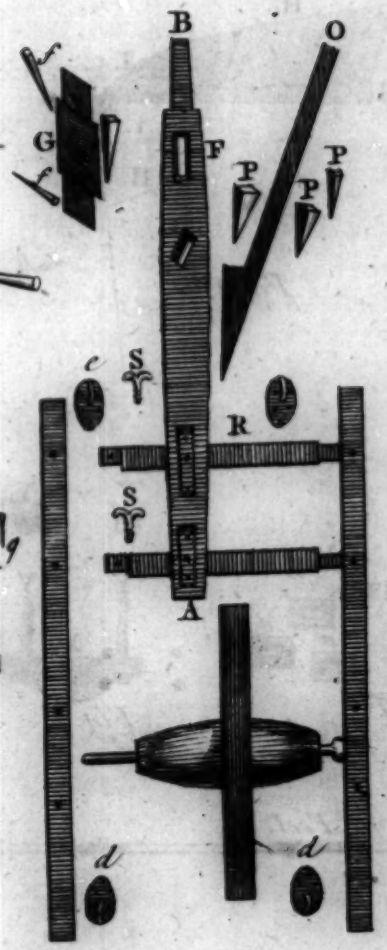
Fig. 2.

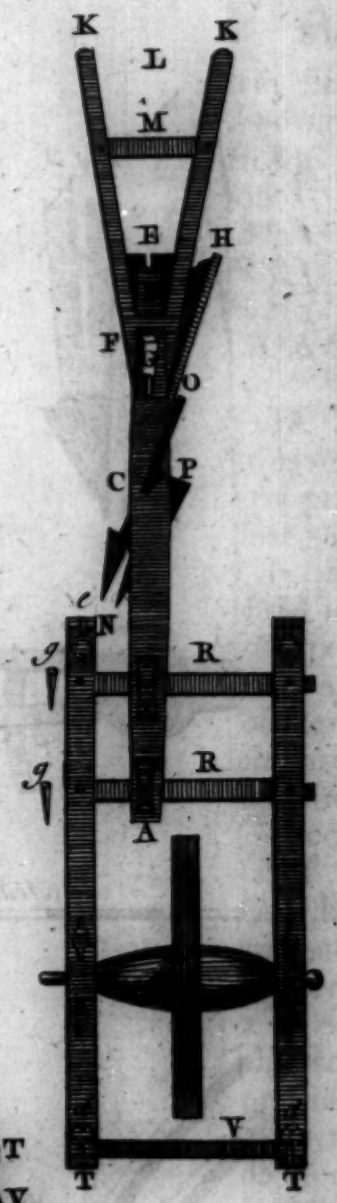


Fig. 5.



Fig. 4.





Scale of 6 Feet

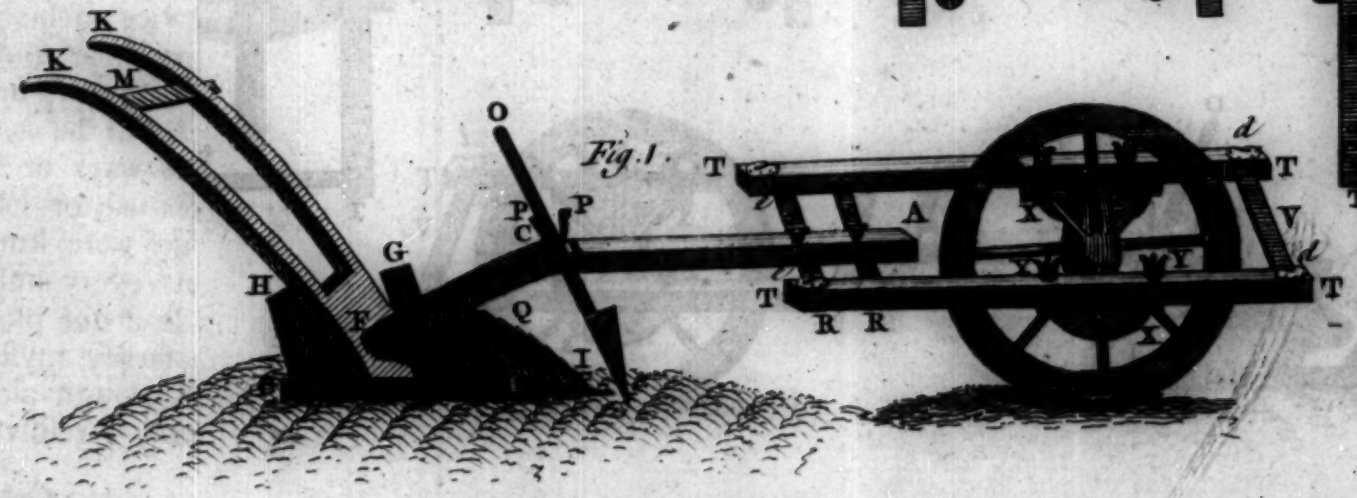


Fig. 1.

J. Goldar sc.

of ground which I knew to be incapable of naturally producing any thing. Some years before, I had dug away the earth, three feet deep, from a ſpace of ſixty ſquare perches. Nothing remained in it but a white clay, like that which potters uſe. This ſpot, thus circumſtanced, ſeemed to me a proper one for my experiment. As the ſpace was too ſmall for a plough to work in, I had recourſe to the ſpade and hoe. The ground was laid out in beds, which were afterwards ſowed with wheat, and the ſpaces between them were frequently ſtirred. The firſt year, my plants were very poor, and branched into only two, three, or four ſtalks a-piece. In the ſecond year, they did much better; and in the third, they were as large and fine as any my garden could have produced. This ſpot ſtill continues to produce equally well; the ſoil is now like fine mould; and, which is very remarkable, it has loſt it's former white colour, and is become black. We have here a ſtrong inſtance of what may be done by pulverizing the earth. Let us but do the ſame with any of our bad lands, and perſevere in plowing and ſtirring them a ſufficient time; the ſucceſs will not be doubtful."

"To be ſtill farther convinced of the truth of this important maxim in huſbandry, that *the earth ſhould be thoroughly looſened by deep and frequent plowings*, I examined very carefully [c], whether my lands which had been prepared by repeated plowing only, without the aſſiſtance of any dung or manure, were more looſened and rendered lighter, than thoſe which were under the common management. All my obſervations proved that they were. The firſt glance of my eye ſhewed me, that their ſurface was ſmoother; on ſounding the

[c] *Ibid. p.* 285.

furrows,

furrows, I found them deeper; and much leſs ſtrength was required to plow them; two horſes, or ſometimes only one, or a ſingle ox, doing here with eaſe, what would otherwiſe have employed double that number of cattle: a manifeſt proof that my grounds were in excellent tilth; whereas the common fields offered nothing pleaſing or ſatisfactory to the eye; the earth there was extremely hard, cloſe, and compact, and it's ſurface almoſt as firm as that of a beaten road. The ground which had been well and often plowed remained ſo light and ſoft, after it's crop of wheat was taken off, that I thruſt a ſtick of green willow eight or ten inches deep into it without the leaſt difficulty, though I could not by any means puſh it at all into the land cultivated in the common way.

Camillo Tarello, a native of Lonato in the Venetian territories, concerned to ſee the neglected and dreadfully miſmanaged ſtate of huſbandry in his country, wrote his ſmall, but highly valuable treatiſe of Agriculture, and preſented it to the Senate of Venice under the title of *Ricordo d'Agricultura*. The Senate, in juſtice to the excellency of this work and the patriotic intentions of it's author, granted him, on the 29th of September 1566, not only the ſole right of vending his book, but alſo ordered at the ſame time, that all ſuch as adopted his new method of huſbandry, ſhould pay to him, and afterwards to his deſcendants, four *marchetti* (about three halfpence of our money) for every acre of corn land, and two *marchetti* for every acre of other land, planted according to his direction. The Berne Society have favoured the public with the firſt part of Tarello's excellent treatiſe, and I ſhall take from thence[d] the following extract, as a farther proof of the neceſſity of thorough plowing.

[d] *Tom.* II. *Par.* 3. *p.* 670.

"When

"When we conſider, ſays that good patriot and intelligent huſbandman, Camillo Tarello, that every ear of wheat yields fifty grains (we will ſuppoſe that to be the medium number), we may infer, that if all theſe were ſowed and grew, we ſhould reap fifty times as much as was ſowed: but our crops are far from being ſo abundant. This failure cannot proceed from any other cauſe than that all theſe grains do not riſe and proſper; nor can any but one, or all, of the ſeven following reaſons be aſſigned for it, if we except bad ſeaſons and extraordinary accidents,

"The deficiency ariſes either 1, from the ſeed; or 2, from rain, when the corn is in bloom; 3, from winds, when it's ſtalks are large; 4, from birds which eat up the grains that have been ſown; 5, from worms and inſects; 6, from the earth; or, 7, from the cultivator himſelf.

"The cauſe of this defect is not in the ſeed: for, either the ſeed is good, or it is not: if it be not good, the grains will not riſe at all; but if it be good, as we ſuppoſe it to be, each grain may, and ſhould, produce at leaſt one ear. Another proof is, that if a parcel of ſeeds are planted at a proper depth, one by one, in holes made on purpoſe for them, and an equal number of the ſame kind of ſeeds are ſowed at random in the ſame ſort of ground, all the former will riſe, but not all the latter.

"Neither ought it to be aſcribed either to rain or winds, at the time of the bloſſoming of the corn: becauſe we do not reap fifty for one, even when the weather is then very fine; and even when each ear bears fifty grains, we do not reap fifty times the ſeed.

"Nor ought we to accuſe the birds of the air: it being well known that lupins which they never touch on account of their bitterneſs, do not all riſe;

riſe; for if they did, the crop would be ſtill more conſiderable, as each of theſe plants bears from fifty to ſixty ſeeds. Beſides, what the birds eat is not conſiderable.

"Worms and inſects are not the cauſe, for three reaſons, firſt, our crops are very little better even when neither worms nor inſects are to be ſeen; ſecondly, the caſe here is the ſame as that of the lupins; and thirdly, the worms would ravage whole fields (as they ſometimes do) in ſo viſible a manner, that it would be eaſy to diſtinguiſh the cauſe of the miſchief. However, this is an extraordinary and pretty rare event.

"The ſame may be ſaid of fogs, cold, bad weather, reptiles and other miſchievous creatures. Though theſe enemies do not injure our fields every year, we nevertheleſs conſtantly reap leſs corn than they might be made to produce.

"Laſtly, the earth is not in itſelf the cauſe of this ſcantineſs of increaſe: for the Creator has endowed it with perpetual youth and fruitfulneſs, as Columella juſtly and prettily obſerves in the firſt chapters of his firſt and ſecond books. The earth and nature are always the ſame.

"Now, if the uſual cauſe why we do not reap fifty for one cannot be imputed to either of the things abovementioned, it muſt of neceſſity be ſought for in the ignorance, negligence, and indolence of the huſbandman: for our practiſe is diametrically contrary to that of the ancient Romans. They plowed often, and ſowed little; yet every family lived upon the produce of it's ſmall farm *; but we, who plow little and ſow a great deal, are

* Romulus granted but two *jugera* to each family; this allowance was afterwards increaſed to five; and then, by the Licinian law, to ſeven, which was the greateſt portion of land ever allotted to any family whilſt the Agrarian law ſubſiſted.

always

Plowing

always poor and indigent. As Petrarcha's proverb, has it, *Who graſps too much, does not hold faſt* †.

"Setting aſide theſe cauſes, which it is not in our power to regulate, I ſay, that the ſeed, ſuppoſing it to be good, does not yield ſo great an increaſe as it might do, becauſe the earth is not brought to ſufficiently good tilth, or properly manured."

I am very ſorry that, not having yet been able to procure Tarello's work in the original, I cannot here give his particular directions for the management of land, any farther than to obſerve, that he directs, as eſſentially neceſſary to good huſbandry, eight plowings during every fallow: agreeable to which was the practice of the ancient Romans, who, as Pliny imforms us [e], plowed their land in general at leaſt five times, and in Tuſcany nine times.

"There are, ſays Mr. Evelyn [f], who fancy that "a long expoſure of earth, before it be employ-"ed for a crop, cauſes it to exhale and ſpend the "virtue which it ſhould retain: but provided "nothing is ſuffered to grow on it, there is no "danger of that; there being in truth no com-"poſt or letation whatſoever comparable to this "continual motion, repaſtination, and turning of "the mould. By the toil we have mentioned, it "is found, that a ſoil may be ſo greatly altered "from it's former nature, as to render the harſheſt "and moſt uncivil clay obſequious to the huſ-"bandman, and to bring forth roots and plants, "which otherwiſe require the lighteſt and hollow-"eſt mould."

One of the juſtly celebrated preſident Monteſquieu's tenants, near Clairac, reaped a great crop of Spaniſh wheat from his farm, at a time when

† *Tutto'l mondo abbraccio, e nulla ſtringo.* [e] *Lib.* XVIII. *c.* 20. [f] *Philoſophical Diſcourſe of Earth, p.* 300.

all his neighbours had very bad crops. The Preſident aſked him, how he had managed to have ſuch extraordinary ſucceſs: to which the huſbandman anſwered, that he had plowed his ground eleven times between ſeed time and harveſt, and that, by this means, he had reaped the benefit of all the rains, dews, fogs, &c. whilſt his neighbours lands were not at all bettered by them, on account of a dry hard kind of cruſt, which grew over them, for want of plowing. — M. de Chateauvieux, who relates this fact, adds [g], that he does not mean to infer from it, that land ought to be plowed quite ſo many times; but that he mentions it rather as an example which ſhews, that the welfare of the public would be greatly promoted by more frequent plowing than is generally practiſed, and that an active, intelligent, and induſtrious huſbandman will always reap the fruit of his labour and expence.

Thoſe muſt be very unſkilful people, little deſerving the name of huſbandmen, who talk of being afraid of plowing out the heart of the ground, as they term it, and pretend that the moiſture of the earth eſcapes more eaſily from a finely looſened and well ſtirred mould, than from a ſoil of which the ſurface is grown hard. Repeated experience, particularly in the horſe-hoeing huſbandry, has, for many years paſt, proved the very contrary, and ſhewed, that the land which has been moſt thoroughly and deepeſt plowed, conſtantly retains the greateſt degree of moiſture. The reaſon of this is judiciouſly aſſigned by the Rev. Dr. Eliot of New England, in a moſt laudable attempt to eſtabliſh a periodical publication in that country, under the title of *Eſſays on Field huſbandry*. "Repeated plow-"ings," ſays he [m], "fit the land to receive and

[g] DUHAMEL, *Culture de Terres, Tom.* IV. *p.* 325. [m] *Eſſay* V. *p.* 18.

"retain

" retain all the benefits of the atmoſphere. When " land is made fine to a good depth, it is prepar- " ed with open mouths to drink in and retain " the dew. When the dew falls upon land that is " untilled, the ground being hard, it does not ſink " deep, ſo that the next day's ſun carries it off " again. It is the ſame thing if the land be too " light and looſe. There is not then a ſufficient " connection of parts to convey the dew from one " particle of earth to another."— Mr. Evelyn dug a pretty deep hole in the ground, reduced the earth to fine powder, and put it back into the hole. A drought came on, and the powdered earth was moiſt to the bottom, when the adjoining land was exceeding hard and dry.

The deſign of tillage is, to deſtroy weeds, and to reduce the earth to very ſmall particles, thereby to render it ſufficiently looſe and porous for the roots of ſuch vegetables as are cultivated in it, to extend themſelves with due eaſe in queſt of their neceſſary food. The ſpade is very fit for theſe purpoſes, becauſe it ſtirs the ground eight or ten inches deep, turns it upſide down, and covers the weeds with a quantity of earth, under which they rot. But this method is too tedious, laborious, and expenſive, to be practiſed in large fields. The plough is cheaper and more expeditious: but, in general, it does not ſtir the earth ſo deep, and often turns it over in one great clod, without breaking it into pieces; for the coulter cuts the ſoil almoſt perpendicularly, the ſhare which follows opens and raiſes it up nearly horizontally, and the mould-board turns it over in a lump.

To remedy this inconvenience, and at the ſame time facilitate the pulverizing of the earth, Mr. Tull recommends a plough, of his own inventing, with four coulters inſtead of one. The coulters are placed in ſuch a manner as to cut the earth

which is to be raiſed by the ſhare, into ſlips of two or three inches breadth; ſo that when the plough opens a furrows ſeven or eight inches wide, the mould-board turns over a well divided earth, which does not fall in large clods, as after the common plough. The conſequence of this is, that, on a ſecond plowing, the plough turns up an earth already conſiderably broken, inſtead of meeting with clods and ſometimes even turf, which, having taken freſh root ſince the former plowing, is as difficult to break, as if the ground had never been plowed. Mr. Tull adds, that this plough will ſtir the earth ten, twelve, or fourteen inches deep, and that, by it's making ſuch deep furrows, with proportionably high ridges, a larger ſurface of the earth is expoſed to the influences of the air.

Theſe are, undoubtedly, very great advantages, if they held good in practice: but the reſiſtance occaſioned by the three additional coulters is ſuch as to require a greater number of horſes than the increaſed profit can afford. His obſervation is very juſt, that, eſpecially in ſtrong ſoils, the furrow commonly turned over is too thick, and not ſufficiently divided. The remedy for this is eaſy, and is pointed out by M. de Chateauvieux, with his wonted judgment [h], by proportioning the breadth of the furrow to the greater or leſs degree of ſtiffneſs or lightneſs of the ſoil. His furrows are generally between eight and nine inches wide; and as to their depth, he is guided in that reſpect by the nature of the ground. Sometimes he has plowed a foot deep; but then the furrows were cut narrow, in order to ſuit the reſiſtance of the earth to the ſtrength of the horſes: for it is as eaſy to them to plow twelve inches deep, with a narrow furrow, as it would

h *Ibid. Tom.* II. *p.* 399.

be

be to plow only to the depth of ſix inches, with a wider one.

This points out another error which farmers in general have run into; that of fitting the ſtrength of the plough to the ſtiffneſs of the land; as if it were neceſſary always to cut equally wide furrows, without any regard to the nature or quality of the ground. By this means, a great thickneſs of the ſtrongeſt ſoils is often turned over ſcarcely broken by the plough, and the cattle labour hard to very little purpoſe. Not to countenance ſo injudicious a practice, I have neither deſcribed nor mentioned any plough of more than common ſtrength; becauſe no furrow ſhould be raiſed which requires the draught of more than two horſes, with ſuch a plough, for inſtance, as the Rotheran. The furrows will then be narrower than in the common practice, more broken, and more completely turned over. "They ſhould be "ſo numerous, thick, and cloſe, that it may not "be eaſy to diſcern which way the plough was "drawn: for thus the roots of weeds are torn up, "and killed. The land ſhould be ſo reduced into "duſt, by plowing it over and over again, that it "may require very little or no harrowing at all, "when ſowed; for, ſays Columella [i], the ancient "Romans thought that land badly plowed, which "wanted harrowing after the ſeed was ſown. The "huſbandman, continues he, ought frequently to "examine whether it be rightly plowed; not by "barely looking at the ſurface, for there his eyes "will often be deceived, and not be able to diſ-"cern the baulks hid underneath; but, which is "leſs liable to deceit, by thruſting a ſtiff pole "croſs-wiſe through the furrows, in various places. "If it penetrates equally, without any reſiſtance,

[i] COLUMELLA, *Lib.* II. *c.* 4.

" he may conclude that his ground, ſo far, has " been duly ſtirred; but if harder parts oppoſe " the paſſage of this pole, he has a proof that the " ground there has not been rightly plowed. " When the plowman, ſees this frequently done, he " will not dare to be guilty of making baulks. — " Great care ſhould be taken not to plow any land " when it is miry and poachy, or half-wet with " ſmall ſhowers; as is the caſe when a light rain, " after long drought, has wet only the upper part " of the clods, without penetrating deeper: for " ſuch lands as are plowed when full of ſlime and " dirt, will not be in a condition to be handled " the whole year after; nor will they, at ſeed " time, be fit either for ſowing or harrowing."

Deep plowing, where the ſtaple of the ground admits of it, will be of great ſervice to whatever corn is ſown in it: for the ſmall fibres of the roots, which are the mouths that ſupply the plants with nouriſhment, penetrate a great way into the earth. Mr. Miller[k] has traced many of them upwards of three feet, and believes they ſpread much farther where the ſoil is light. It therefore is of great importance that the ground be well ſtirred and looſened to a ſufficient depth: for by this means the roots will find a ſupply of paſture for the nouriſhment and increaſe of the ears, at the time they are forming, when it is moſt wanted: whereas if it be plowed ſhallow, they will have reached the bottom of the looſened mould by the ſpring, and not being able then to penetrate farther, the ſupply of food neceſſary for the ſtalks will at once fall ſhort. From this cauſe we frequently ſee the colour of the blades of corn change in April; nor do they often recover their former verdure: and when this happens, the ſtalks are always weakened

[k] *Gardener's Dictionary, Art.* PLOWING.

in

in proportion to the decay of the blades; for it is well known from long experience, that the leaves or blades of corn are neceſſary to draw in nouriſhment from the air and dews, for the increaſe of the ſtalk and ear.

A doubly deep plowing is requiſite from time to time[1]. This may be given by making the plough go twice in the ſame furrow, ſo as, with the help of a ſhifting mould-board, ſtill to turn the earth over to the ſame ſide. However, this operation is not to be repeated every year, on account of the expence, and becauſe new earth ought always to be expoſed for ſome time to the effects of heat and cold, in order to it's being fertilized: but it is not a leſs certain fact, that this deep plowing, if performed only every third, fourth, or fifth year, is a kind of renewal of the whole ſoil, where it is practicable, that is to ſay, where it does not cut into a bed of gravel, ſand, or other abſolutely unfruitful earth; though this may alſo have it's very great uſe in ſome caſes, by effecting ſuch a mixture of different ſoils as will prove equivalent to the beſt manure, and be far more durable than any artificial dreſſing. Some people imagine that new earth is barren, and hurtful to land: but experience will ſoon ſhew the contrary, if they conſider the practice of gardeners in digging their ground. It muſt however, be allowed, that plowing to a double depth is attended with ſome ſmall inconvenience the firſt year: for which reaſon it is beſt to give this plowing before winter, eſpecially the firſt time, and not to ſow till ſpring; nor then, any but the leaſt valuable grains. Froſt has a peculiar virtue to break the clods and looſen the earth: from whence it follows, that it is highly proper to plow once more before the winter

[1] *Memoires de la Societé de Berne, Tom.* II. *Par.* 3. *p.* 621.

actually ſets in, thoſe places which are intended to be ſowed with ſpring corn in the beginning of the next year. The ſpring plowing, in this caſe, need be but light: but if, on the contrary, the plowing before winter has not been a thorough one, the ſpring plowing muſt be ſo much the deeper.

If the farmer finds that one ſummer's fallow does not intirely anſwer the purpoſe of dividing and looſening the earth, it is his intereſt to continue it for another. M. Tull confirms this, by inſtancing a poor man, whom neceſſity compelled to take this method, becauſe he could not get ſeed for his ground after he had tilled it the firſt year. The conſequence was, that his crop was worth more than the value of the land it grew on. Mr. Maxwell too, mentions [m] another, who, from a like neceſſity, followed the ſame courſe upon almoſt his whole farm, had ſuch a crop as enabled him to pay many debts, and, by continuing the ſame practice, came in few years to be in a condition to purchaſe the farm *.

When the huſbandman intends to break up any piece of land, the firſt thing neceſſary, is carefully and judiciouſly to examine the ſurface of the ground, and it's depth. If the ſurface be covered with a thick, ſtrong, fibrous turf, and the mould underneath ſufficiently deep, his beſt, and indeed the only right method of proceeding, is excellently well directed by the marquis of Turbilly, in the

[m] p. 101.

* Theſe inſtances confirm the juſtneſs of what VIRGIL ſays,

Illa ſeges demum votis reſpondet avari
Agricolæ, bis quæ ſolem, bis frigora ſenſit;
Illius immenſæ ruperunt horrea meſſes.
GEORG. I. v. 47.

That land rewards the greedy peaſant's pains,
Which twice the ſun, and twice the cold ſuſtains;
'Twill fill his crowded barns with more than promis'd gains.

pre-

preceeding chapter. But if, on the contrary, the upper mould be ſhallow, or ſo thin turfed as not to be fit for burning, he muſt obſerve, whether his ſoil be of a ſtrong, or of a light quality. Under the former of theſe are included, as has been more particularly explained in the firſt chapter of this work, all deep hard clays, of what colour ſoever; all ſtiff binding earths, and ſuch as, after being expoſed to the ſun, or froſt, grow hard and ſtony; with ſuch as chop and cleave upon their ſurface in the heat of ſummer: and under the latter are ranked (the repetition may be excuſable here for the ſake of perſpicuity), all ſandy, mouldering, gravelly, mellow ſoils; all looſe and open earth, of what nature ſoever; all ſuch as are not ſticky, but will ſoon dry after rain; and, inſtead of lying in great lumps after plowing, are eaſily apt to diſſolve, and crumble into mould, not being ſubject to bind by the heats in ſummer, or froſts in winter. If, upon examination, the ſoil is found to be of the ſtiff kind, particular care muſt be taken to turn down it's ſurface in the latter end of autumn, that what fibrous roots there are in it may be the more effectually rotted againſt the ſummer plowing, and that the earth may be mouldered, or mellowed, by the winter's froſt and rains.

When plowed land is intended to be fallowed, it ſhould likewiſe be plowed in the autumn, as ſoon as the ſeed time permits, and laid as rough as may be, eſpecially if it be a ſtiff ſoil, that the winter's froſt may mellow it.

In the ſpring, the farmer ſhould take the earlieſt opportunity that his ſpring crops will admit of, to give his fallows a ſecond plowing a-croſs the former; after which the ground ſhould be well harrowed, not only to break the clods, but to pull up ſuch roots as are not yet rotted, that they may be

be gathered into heaps and burnt. It is eſſentially neceſſary that this, and all the following plowings and harrowings be performed in dry weather; becauſe, as the purpoſe here is thoroughly to looſen the mould, ſpecial care ſhould be taken to avoid every thing which might counter-act that intention. The farmer cannot wiſh for a greater benefit to his huſbandry, than moderate ſhowers after each fallow, to bring the ſeeds of every weed to vegetate, in order that, being turned down by the ſeveral plowings, they may be the more effectually deſtroyed.

It ſeems needleſs to mention when the future plowings ſhould be given, becauſe the farmer ſhould take every opportunity of repeating both them and the harrowings, in full confidence that he cannot over-do it, eſpecially in ſtrong ſoils; in which he may alſo be equally certain, that he cannot err in plowing too deep: for it is of great conſequence, not only that the roots have a ſufficient depth of mould to penetrate in, but alſo that the cold clay be removed to as great a diſtance as poſſible from the ſurface; becauſe, by it's retaining the water, the roots of plants are chilled and killed, eſpecially in the winter, when they reach ſuch ſtagnating wet. If any manure is applied to alter the quality of the ſoil, it cannot be laid on too early in the ſummer, that the plowings may the more effectually mix it with the earth; but if only compoſt be uſed for enriching the ſoil, it need not be ſpread till juſt before the laſt plowing.

Authors give directions for plowing land into many different forms, moſtly ariſing from the different natures of ſoils, but too often from the particular long eſtabliſhed cuſtom of countries, the reaſonableneſs of which is not always ſufficiently conſidered.

Where

Where there is a deſcent for water, all lands ſhould be laid flat, becauſe, in that way, the rains will undoubtedly give a more equal nouriſhment to the crop, than when they are raiſed in ridges. The practice of laying light ſoils into narrow ridges, for wheat, is certainly owing to want of attention; and even in ſtrong land plowed for winter fallowing and ſowing, I am much inclined to think that the beſt way would be, inſtead of ſingle bouts, or narrow ridges, to make the ridges very broad, and lay them up high: for if the ground is level, the water will lie in the parting thoroughs, and, by ſoaking into the ſides of the ridges, make it ſo poachy, as to render it very unfit to be worked, till late in the ſpring, unleſs the ſeaſon be very dry; or, if there is much deſcent, great part of the beſt ſoil will be carried off. For the ſame reaſons the ſides of hills ſhould always be plowed almoſt, but not quite, horizontally, that the parting thoroughs, lying open, may ſerve for drains to the water: beſides which, the plowing of ſuch declivities in this ſloping manner is by much the leaſt laborious both to men and cattle. The furrow here ſhould always be drawn oblique, as Columella directs [o], ſometimes a little toward the higher, and ſometimes toward the lower part of the hill, ſo that the direction may be altered in each ſubſequent plowing.

The erroneous opinion of thoſe who imagine that the ſurface of the ground is conſiderably enlarged by plowing it into high ridges, and that it therefore affords a larger ſpace for the growth of plants, is thus judiciouſly refuted by M. Duhamel [p].

"The produce of a ſloping ſurface is not greater than that of a plane equal in extent to the baſe of the ſlope: for as the plants grow perpen-

[o] *Lib.* II. *c.* 5. [p] *Culture des Terres, Tom.* I. *p.* 101.

dicular

dicular to the horizontal baſe, there is no point of the ſlope which does not anſwer vertically to a point of that horizontal baſe: therefore, ſuppoſing the furrows of a piece of ground plowed in broad-lands to be ſix inches deep, and the ridges ſix feet wide; the ſlope from the bottom of the furrow to the middle of each ridge will be one foot in ſix, which is indeed conſiderable: but ſtill the ſurface of the ridges will be to that of their horizontal baſe, only as 76 are to 75: a ſmall advantage; eſpecially when compared to a ſixth part of the ground, which is taken up by the furrows, and in which no corn is ſowed.

Another, and that very eſſential, advantage of fallowing, not yet ſufficiently inſiſted on, is, the deſtruction of weeds, which are one of the farmer's greateſt enemies. By weeds, I here mean every plant which grows ſpontaneouſly in the field, without having been purpoſely ſown, and which it is not the huſbandman's intention to cultivate. All theſe ſhould be rooted out. It would be needleſs to enumerate them after this general definition; and perhaps equally ſo to obſerve, what every huſbandman muſt know, that cockle, darnel, fox-tail, wild poppies, wild vetches, wild oats, dog's graſs, colt's foot, melilot, knot-graſs, thiſtles, and charlock, are the moſt hurtful ſpecies of theſe noxious growths, and the moſt difficult thoroughly to extirpate.

To prevent the increaſe of weeds, they ſhould be deſtroyed before their ſeed is ripe: but that is not poſſible in lands which are plowed in the common way; becauſe, as they grow intermixed with the corn, and ripen ſooner than wheat, their ſeeds ſow themſelves: neither can they be extirpated by reſting the land; for the ſeeds of ſome of them will remain ſound ſeveral years in the earth. If a field in which there are many

poppies,

poppies, or red-weeds, as they are called in ſome places, be ſowed with ſainfoin, ſcarce a poppy will appear the ſecond year: but when the ſainfoin is plowed up, even at the end of nine years, the red-weed frequently appears a-new; which can hardly be owing to any other cauſe, than that it's ſeeds have remained ſound in the earth during all that time; for very few of them, in proportion to the quantities, which ſpring up, can have been brought from the neighbouring grounds, or in dung. This is confirmed by an experiment which M. Duhamel made [q]. He ordered the earth with which a ditch had been filled fifteen or twenty years before, to be dug out, and ſpread upon a piece of plowed land. Several plants, of different kinds from any that were in the field, ſprouted up in the place where this earth was laid. Conſequently they were produced by ſeeds which had remained ſound in the ground, during the fifteen or twenty years that this earth had laid in the ditch.

This is an important reaſon for plowing thoroughly all lands which are fallowed: for it is certain that, as numbers of ſeeds ſhoot up during the fallow, repeated plowing will deſtroy many of them. But there are ſeveral kinds of plants, ſuch, in particular, as wild oats and fox-tail, the ſeeds of which do not ſprout till they have remained two or three years in the earth; nor will culture make them grow ſooner. Such, at leaſt, is M. Duhamel's opinion, as well as that of ſeveral other very ingenious gentlemen; though it muſt be confeſſed, that ſome late experiments ſeem to contradict it, and to ſhew, that the ſeeds of thoſe plants which he ſays require being three years in the ground before they will grow, were only buried ſo deep, in the caſe he mentions, as

[q] *Ibid. p.* 142.

not

not to be able to vegetate, which they afterwards did when laid within reach of the influences of the air, rain, dew, &c. If ſo, though the increaſe of weeds may be prevented for ſeveral years, by plowing, cutting, pulling them up, &c. yet it is evident that the repeated plowing of fallow lands, far from immediately deſtroying theſe kinds of weeds, will rather help them to grow, when their ſeeds are brought within a proper diſtance from the ſurface, and their time of ſprouting is come. But then, allowing that ſome of their ſeeds may be thus brought up by each plowing, for a while; it cannot be long before all of them will have ſprouted, after which the ground may be kept quite clear, with proper care.

Huſbandmen have not yet found a more effectual method to deſtroy weeds, than by ſowing the ground out of ſeaſon; that is to ſay, by ſowing oats the year that barley ſhould be ſowed. It has been experienced, that, by this means, ſome kinds of weeds have been deſtroyed, which, appearing only every third year, never ſhew themſelves, in the uſual rotation, but amongſt wheat. But the farmer looſes a crop by this means, and ſtill has ſo many weeds left, that he is obliged to hire people to weed his corn. This is done two ways.

A number of women place themſelves in a row, and with a hoe made for the purpoſe, cut up all the weeds they ſee, ſuch as thiſtles, bluebottles, poppies, &c. But many of theſe, when young, frequently eſcape their notice; in which caſe the hoeing muſt be repeated when they are grown larger; and the ſmaller weeds, ſuch as wild vetches, wild oats, darnel, knot graſs, fox-tail, young poppies, &c. which are at leaſt as hurtful as the other, remain in the field. Beſides this, in cutting the weeds, it is ſcarce poſſible not to cut down ſome of the corn; and the roots of the thiſtles

thiſtles and other biennial plants which are cut, produce two or three new ſtalks in lieu of the old one; by which means the evil is increaſed.

The other method of clearing corn, is by hand-weeding it; but this is ſeldom practiſed by farmers, becauſe it is too expenſive: and indeed the women and children generally employed to do this work, moſt commonly pull up a great deal of corn with the weeds; ſo that, what with that, and with their trampling, and dragging their bags of weeds over it, they frequently do more hurt than good; eſpecially if the earth be moiſt.

The ſureſt way to deſtroy weeds, is, to continue plowing while the corn grows: but this can be done only in the new huſbandry.

Weeds may be ranked under four general claſſes: 1, ſuch as have creeping perennial roots: 2, ſuch as grow in cold wet ſoils: 3, ſuch as are of a large ſucculent body; and, 4, ſuch as, having ſmall ſeeds, or ſeeds which ripen before the corn, ſow themſelves. Each of theſe require a different treatment.

The firſt ſort cannot be deſtroyed but by repeated ſummer fallows, by which their roots are cut, and turned up to be withered by the ſun and winds, after which they are dragged out by harrows, and ſhould be burnt. This, repeated as often as the farmer conveniently can, eſpecially during a dry ſeaſon, can ſcarcely fail to have the deſired effect. Colts-foot, which is propagated by the root, and is a very pernicious weed, may likewiſe be deſtroyed by ſowing the ground with rye-graſs, or any plant which, coming up early in the ſpring, ſhades and ſmothers it; for that will kill it in a few years.

The ſecond kind are deſtroyed by draining the earth of it's ſuperfluous moiſture, and by manuring it with lime, aſhes, gravel, ſhelly ſea-ſand, and other

other proper correctives, before mentioned, for ſuch ſoils.

The third are extirpated by cutting them down when in full ſap and vigour: for the ſap being thereby ſuddenly interrupted in the courſe of it's circulation, ſtagnates in the roots, and putrifies there. A few weak lateral ſhoots may be made; but if they are likewiſe cut in the ſame manner, the roots will putrify intirely by degrees, and, inſtead of annoying, will become a manure.

The fourth claſs can be deſtroyed only by frequent fallows, and conſtant cutting, or rather plowing them down before they run to ſeed. Some, for inſtance the wild oats, may be mowed for hay: but it is much more beneficial to the land to plow them in: becauſe, by that means, inſtead of being exhauſted by frequent crops, it is manured by thoſe enemies to uſeful grain.

Banks and hedges ſhould be carefully kept free from weeds; not only to preſerve their bottoms thicker, but alſo to prevent the ſeeds of weeds from being carried into the adjacent fields, by winds, by which means the corn would be perpetually peſtered with them.

SECT. II.

Of Sowing.

WHEN the earth is properly prepared for ſowing, the next moſt eſſential points to to be conſidered are, 1. The choice of the ſeed; 2. The preparation of that ſeed; 3. The time of ſowing; and 4. The manner of ſowing. I ſhall therefore treat of each theſe in their reſpective order.

ARTI-

ARTICLE I.

Of the choice of Seed.

THE choice of the ſeed intended to be ſowed is an object of greater importance than many farmers ſeem to imagine. It is not ſufficient that the fineſt grains be choſen for this purpoſe, unleſs they are likewiſe very clean. Such wheat is not difficult to be had from land cultivated according to the principles of the new huſbandry; but we ſeldom find corn intirely free from ſeeds of weeds when it has been raiſed in the common way.

It is natural to ſuppoſe, that the grains of ſtinted and ſickly corn neceſſarily partake of the weakly diſpoſition of the plant which produced them, and that their productions cannot be ſo fine as thoſe which grow from the ſeeds of ſtrong and healthy plants. For this reaſon Mr. Tull adviſes to take the ſeed corn from a richer ſoil than that in which it is to be ſowed, and rather from ground in perfect tilth, than from land which has been leſs carefully cultivated. This ſeems to be very right (though the contrary opinion is almoſt generally received), becauſe more may reaſonably be expected from the productions of a fine good ſeed, which are full of vigour and well conditioned, than from a poor weak plant.

M. de Chateauvieux, who often ſowed with no other intention than merely to try, for the benefit of mankind, at what time, in what manner, and in what condition it is beſt to ſow wheat, found that this corn ſprouted pretty well even when ſowed ſo green that it had not yet loſt it's milky quality; but thinks it much more adviſeable to ſow none but what is thoroughly ripe: becauſe the

ſeed has then attained it's full perfection, from whence we may moſt certainly expect the beſt and ſtrongeſt plants.

"The wheat ſays he [a], which has been reaped in a warm dry year, ſeems to me fitter for ſowing, than that which has been gathered in a cold wet ſeaſon: for in ſuch a time as this laſt, all the productions of the earth are leſs good; their taſte is leſs ſavoury; and as that corn in particular in which there is moſt moiſture, is moſt difficult to keep, I infer from thence that the formation of it's grain muſt be leſs perfect. I ſhould therefore prefer wheat a year old, provided the year it was gathered in was warm and dry, to that which may have juſt been gathered in too rainy a ſeaſon: for the ſame reaſon, I always chooſe for ſowing, wheat of the growth of my high grounds, rather than that which has been produced in flats. The benefit accruing from all this care, may, perhaps, not be extremely great; but at the ſame time it does not coſt any thing. Let us do in agriculture what is done in all manufactures, where the very ſmalleſt profits, the very leaſt ſavings, are not neglected. Thoſe ſmall articles, often repeated, make large ſums in the long run, and are a real gain."

"Another thing, of greater conſequence, firſt made known to me by chance, but ſince confirmed by repeated experiments, always attended with the ſame ſucceſs, I ſtrongly recommend as extremely ſerviceable to the firſt ſprouting of the ſeed. — In my experimental ſowings, I commonly uſed wheat taken from the heap in the granary; and likewiſe, frequently, corn picked out of the ears the moment before I ſowed it. I counted exactly the grains of both ſorts, and ſuppoſe that

[a] DUHAMEL, *Culture des Terres, Tom.* IV. *p.* 3.

few

few will think there could be any difference in their productions. Yet I found a conſiderable one. What was picked out of the ears always roſe extremely well; ſcarce a grain of it ever miſſed; whereas numbers of thoſe which were taken from the heap, never ſprouted at all. I did not perceive this difference at firſt; but at laſt it ſtruck me. I relate the fact as it is, without pretending to account for the cauſe of this difference, which would lead me into too long a digreſſion. The experiment itſelf may be of real uſe, by ſhewing us, that inſtead of threſhing the wheat intended for ſeed at any time, without diſtinction, it ought not to be threſhed till a very few days, at moſt two or three, before it is ſowed. A few hands will be able to ſupply the ſeeds-men with as much as they will want: nor will this method, which may be a means of ſaving ſomewhat in the ſeed, be attended with any extraordinary expence."

"Perhaps too, this practice may be attended with a very valuable advantage. I have not indeed yet made the trials neceſſary to ſatisfy myſelf of what I imagine; but my deſire to be of ſervice to the public induces me to mention it, that the lovers of agriculture may reflect upon it, and try ſuch experiments as will clear up my conjectures."

"Threſhing the ſeed only juſt before it is ſowed, may poſſibly, in ſome meaſure, or perhaps intirely, prevent the cauſe of *ſmut* in wheat. By this I mean, that the ſeed which has not been mixed with ſmutty corn, or any way infected by it's black powder, will be exempt from that diſtemper. Not that I take that black powder to be abſolutely the original cauſe of this diſtemper in corn; but I believe it is very capable of communicating it to grains which are ſound."

Seed

"That nothing may be neglected which can be of any ſervice to the ſeed, great care ought to be taken in threſhing the corn, eſpecially in the manner that buſineſs is commonly performed, with flails, upon the barn floor: for a great number of grains are frequently ſo much bruiſed thereby, that it is impoſſible they ſhould ever grow. If the wheat thus threſhed for ſeed is not thoroughly dry and hard, the miſchief is ſtill greater; much more of it being then abſolutely cruſhed by the flail."

"As ſowing in drills requires leſs ſeed than is uſed in the common method, it will be the eaſier to execute there an operation which might be too long and troubleſome for ſo great a quantity as is uſed in the old way. The method which I adviſe, and which I have practiſed, is this. Let one or two beams, two feet and a half, or three feet thick, be laid a-croſs the barn floor: let the threſhers ſtand on each ſide of the beam, and take out of looſe ſheafs of wheat, one of which ſhould be placed behind every man, a handful at a time, and give it two or three ſtrokes againſt the beam. This will bring out a great deal of grain, which is to be reſerved for ſeed. The ears thus ſhaken may be bundled up again, and afterwards threſhed out with the flail, for other uſes. This method is not ſo tedious as ſome may imagine: we are ſure that not a grain is bruiſed; and thoſe are the moſt perfect which drop out thus. I think I may compare this operation with what is done in the making of wine, where the firſt running is always the higheſt flavoured and beſt."

Another excellent way to ſeparate the fulleſt, and conſequently heavieſt grains, which are undoubtedly the fitteſt for ſeed, from thoſe which are of leſs value for that purpoſe, and at the ſame time

time to clear them from many ſeeds of weeds, is, to make a ſtout man, with a broad wooden ſhovel, throw the corn with all his force towards an oppoſite corner of the barn, or rather of a large boarded hall, which generally is the fitteſt for this work. All the light, ſmall, ſhrivelled grain, unfit for ſowing, and the ſeeds of cockle, darnel, &c. not being ſo heavy as the ſound ſolid corn, will fall ſhort, and lie neareſt to the man who throws them; while ſuch as are large, plump, and weighty, out-flying all the reſt, are ſeparated widely, and may eaſily be gathered up. Experience will ſhew the vaſt advantages of ſowing ſeed thus choſen.

ARTICLE II.

Of preparing the Seed.

THE uſe of *Steeps* was introduced very early into huſbandry, not only as a means of preſerving corn from ſeveral diſtempers to which it is ſubject, but alſo with a view to render the ſeed more fruitful. That ſome of them have ſometimes anſwered the former of theſe intentions is undeniable: but with regard to the latter, much ſtronger and oftener repeated evidences than any that have yet been produced, are ſtill wanted to confirm their boaſted efficacy. I ſhall however, give a conciſe account of ſome of the moſt famous of both kinds; with this previous obſervation, that even ſuch of them as have not ſucceeded in ſome caſes, through cauſes perhaps unknown to us, may poſſibly do well in others, when tried with proper judgment, and attention. Experiments of this kind ſhould by all means be continued on a double account; firſt, to take off a prejudice which ſeems to gain ground, though it be not founded on any rational principle; and next, to be well aſſured whether

theſe preparations do, or do not, produce any ſenſible effect. Experiments ſeldom prove uſeleſs to careful accurate obſervers. If they do not always anſwer the end propoſed, they at leaſt ſometimes lead the way to other important diſcoveries.

The Romans had their lees of oil, decoction of cypreſs leaves, juice of houſe-leek, &c. on which they have beſtowed full as much commendation as they merit. Lord Bacon, ſeems [a] to have been the firſt who paid any attention to this ſubject in England: but he has only pointed out the path to others: nor do I know any author who has yet given us a ſet of experiments with this view, long enough continued abſolutely to determine what effects ſome kind of ſteeps may have towards rendering grain more fruitful.

Van Helmont, and, ſince him, the authors of the *Maiſons ruſtiques*, have given many receipts for ſteeps, which they vaunt exceedingly, as increaſing the fruitfulneſs of the ſeed ſteeped in them. But at the ſame time that they recommend theſe receipts, they adviſe ſowing the corn thinner than uſual; generally one third leſs; — a circumſtance which, alone, will add greatly to the crop, as very many experiments, and particularly all the good trials of the new huſbandry, have evidently demonſtrated. That the compariſon may be juſt, all circumſtances ſhould be alike, as to the goodneſs of the ſoil, the quantity and quality of the ſeed, &c.

M. Duhamel, to ſatisfy himſelf whether any benefit does ariſe from the uſe of ſteeps, by way of giving the ſeed a greater degree of fruitfulneſs, tried the following experiment [b]. He infuſed ſome good wheat in a lye of dung, mixed with lixivial ſalts, nitre, and ſal ammoniac, and ſowed with this grain two beds in his kitchen garden, dug with a

[a] *Nat. Hiſt. Cent.* V. 401. *and ſeqq.* [b] *Tom.* II. *p.* 22.

ſpade.

ſpade. One of the beds was ſowed very thick, and the other very thin. At the ſame time he ſowed two other beds, exactly like the former, with ſome of the ſame ſeed, not ſteeped, one thick, and the other thin. At harveſt time, the beds ſowed with the ſteeped ſeed, were ſo exactly like the others, that it was impoſſible for the eye to diſtinguiſh between them.

A gentleman in his neigbourhood followed exactly the directions given in the *Maiſons ruſtiques*[c], in the uſe of one of their boaſted receipts, which is there ſaid to be of ſuch efficacy, that the land need be plowed but once for wheat prepared with it. He did ſo; and his crop was ſcarce worth reaping.

On the other hand, M. Duhamel mentions[d] his being informed by M. Peyrol, many years ſecretary to the intendant of Auvergne, that he had made ſeveral experiments in imitation of thoſe mentioned in the abbé de Vallemont's famous book. In the month of May 1755, he planted in his garden (an indifferent ſoil, in a hot expoſition,) four ſmall cabbages, which then had only four leaves. In September following, the ſame cabbages were ſix feet and a half in circumference. Some plants of red wheat, tranſplanted into a bed dug very fine in his garden, bore 130 ears a piece, each of which contained from 40 to 80 grains. Some plants of white wheat, tranſplanted at the ſame time, produced 120 ears, each of which had from 30 to 40 grains. Two grains of red wheat, ſowed in the ſame bed, and not tranſplanted, produced each of them 140 ears, which contained 6000 grains. Five plants of red wheat, diſtant from one another ſix inches, did not branch ſo well, being too cloſe together: but

[c] *Tom.* II. *p.* 24. [d] *Culture des Terres, Tom.* V. *p.* 164.

each of them produced from 40 to 50 ears, which contained from 40 to 60 grains. Rye, which branches leſs than wheat, produced from 30 to 35 ears, each containing from 60 to 70 grains: and the barley of that country, which branches but little, produced however from 60 to 80 ſtalks, tho' the ſeed of this laſt had not been ſteeped in any liquor before it was ſowed.

The author of theſe experiments judiciouſly obſerves, that they muſt be repeated and varied, before it can be made to appear that the extraordinary increaſe is owing to the ſteep.

This celebrated liquor of the abbé de Vallemont is made as follows.

Put into a tub, expoſed to the ſouth, one buſhel of horſe-dung, the ſame quantity of cow-dung, half a buſhel of pigeon's dung, as much ſheep's dung, as much aſhes, three gallons of ſmall pricked wine, two pounds of ſalt-petre, and as much water as will ſufficiently dilute the whole, ſo as to make it thin enough for uſe. Every time that any of this liquor is taken out to ſprinkle the plants, it is filled up again with water; and as it may be too ſtrong at firſt, it may be weakened accordingly.

It is eſſential to obſerve, that M. Peyrol added to this infuſion frequent digging; for the ground was dug five times between the plants of wheat: and he obſerved that each digging ſenſibly gave freſh vigour to the plants, which grew to the height of ſix feet.

M. Donat, another of M. Duhamel's judicious correſpondents, made trials of theſe mixtures, from the uſe of which ſo much is promiſed; but ſays he thinks them of no other ſervice, than to amuſe the curious, who do not regret expence. As the authors of them boaſt that all kinds of ſoils, whether good, bad, or indifferent, well or ill plowed,

plowed, reſted or not reſted, will produce ten times more than in the common way; this gentleman ſowed a large extent of ground, ſome good, ſome bad, ſome well, and ſome ill plowed, &c. He made the ſteep himſelf, was preſent when the ſeed was ſowed, and took care that no circumſtance was neglected. But, notwithſtanding all his care, his crop was far from anſwering their promiſes. The good, well cultivated ſoil, produced fine wheat; but not extraordinary in point of quantity. The only advantage was in the ſaving of the ſeed The poor ill cultivated land, and that which had not been reſted, produced very little grain; and the very bad ſoil, none at all. Theſe experiments convinced M. Donat, that the ſureſt means of obtaining good crops, is, to have the ground in good condition. This is the principle on which the new huſbandry is founded: nor indeed does it offer any thing marvellous, or contrary to the moſt ancient precepts of good huſbandry.

If there be in any of theſe ſteeps, or preparations, a more than common virtue, by which the grain infuſed in them is rendered more prolific than it would otherwiſe be, poſſibly ſome ſuch benefit may accrue from the following practice, which is recommended by the author of the *New Syſtem of Agriculture*.

"Take, ſays he [e], the corn which is intended for ſowing, and throw it, by a buſhel at a time, into a large veſſel full of water: let a man ſtir it with a ſtaff, as violently as he can, for a conſiderable while together, and then, giving it a little time to ſettle, ſkim off all that ſwims upon the ſurface: repeat this till no more riſes; then take out the corn which has ſunk to the bottom, and

[e] p. 200.

lay

lay it by for ſeed; proceeding in the ſame manner till you have your intended quantity. After this, make a brine of bay-ſalt and rain-water, ſtrong enough to bear an egg. Steep the ſeed corn in this liquor during thirty hours; for leſs time will not have any effect: then take it out, ſpread it upon a ſmooth floor, ſtrew over it a good quantity of fine-ground powder of ſlaked lime, and ſweep the whole up and down till each grain leaves clinging to another, and becomes, as it were, perfectly candied with the lime. It is then fit for ſowing; and will infallibly produce a very abundant crop." Some farmers vary this ſteep, by adding to it a mixture of pigeon's, or other dung; and in moſt parts of France, where this receipt is known, they omit the ſalt; perhaps becauſe it is too dear in that country, and ſteep the wheat in lime weter. For this purpoſe they put it into baſkets, and carefully ſkim off all that ſwims on the top, moſt of which would not ſprout, and is only fit to feed fowls.

The ſociety of improvers in the knowledge of agriculture in Scotland, call the following a very promiſing receipt for multiplying corn: but as no experiment that I know of, duly attended to, has yet confirmed that ſurmiſe, I can only ſay, that it may not be wrong to give it ſuch farther trials as will not hurt the experimentor, whether they do or do not ſucceed: a rule which ſhould be conſtantly obſerved in all experiments.

"Take as much water as will fully cover the quantity of grain you intend to uſe; add thereto a reaſonable quantity of a mixture of horſe, cow, and ſuch other dung as you can conveniently get, ſo as not to make the water too thick: add likewiſe for every boll (four buſhels) you are to ſteep, about a peck or ſixteenth part of the ſame ſort of grain as you are to ſteep. Boil all theſe till the grain is reduced to a pulp; keeping the kettle or cauldron cloſe

cloſe covered, to retain the ſteam. When the boiling is over, pour off the water, and diſſolve in it a pound of nitre, or ſalt-petre, to every four buſhels of corn: then, while it is luke-warm, infuſe your corn for three days, after which, drain off the water, ſpread the grain on the floor, mix it with a ſufficient quantity of ſea-ſand, (if ſuch can be conveniently had), and laſtly, with lime, to dry it, as is uſually done in other caſes."

"It ſeems reaſonable to think," ſay the abovementioned ſociety, "that nothing can be more "natural for impregnating grain, than the ſtrength "and eſſence of itſelf. But, ſince nitre is added, "it is beſt to be cautious: for it has been found "by experience, that ſalts, though they have the "virtues mentioned, kill or deſtroy the vegetative "powers, when the application is immoderate, "either with reſpect to the quantity, or the time "the grain is ſteeped; ſo that there has often "been a neceſſity to ſow over again with the "ſame, or ſome other grain. To make the better judgment concerning this critical affair, "the nature and condition of different grains are "carefully to be conſidered; but the moſt certain knowledge and direction are to be obtained by a courſe of obſervations and experience. Mean while, it is beſt to obſerve the "maxim, *avoid extremes.*

In Mr. Houghton's collection of papers relative to huſbandry and trade[f], are ſeveral experiments on the ſteeping of wheat and barley in a liquor which is there ſaid to have occaſioned a very great increaſe, and is thus made. "Take a quantity of "rain-water, and diſſolve in every gallon of it two "pounds of ſtone-lime: let it ſtand two or three "days, ſtirring it three times a day; then pour

[f] *No.* XIV.

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"off the water into another veſſel, and add to "every gallon of it about four ounces of ſalt-"petre, and one pound of pigeon's dung: mix "them well together, by ſtirring them three or "four times a day, and then ſtrain off the liquor "to keep for uſe." Mr. Everard, who communicated this receipt to Mr. Houghton, ſteeped a handful of wheat in a quart of this liquor, where he let it infuſe eighteen hours: he then took it out, and laid it to dry in the air for the ſpace of one day; and then ſteeped it again in the ſame liquor for about twelve hours, dried it as before, and ſteeped it again a third time, about ſix hours after which he planted it in his garden, which was but common earth, ſetting it by ſingle grains, about ten inches aſunder, and a finger's length in depth. He could not remember whether every grain ſprouted, but thought that very few failed. Thoſe which did grow, produced an extraordinary increaſe, ſeveral of them yielding from ſixty to ſeventy, ſome of them eighty ſtalks, with very large ears full of fine plump corn: many of the ears were ſix inches long, and contained ſixty grains: none had leſs than forty.

He alſo ſteeped peas and beans in the ſame liquor; but could not ſay whether their having been ſteeped too long was the cauſe that none of them came up: but he took the thick ſediment which remained after the liquor was ſtrained off, mixed it with four times the quantity of earth, let it lie all winter in a gravel walk, ſouth of a codlin hedge, then made a row of holes, about four inches diſtant, put a handful of the mixed earth into each hole, with a pea upon it, and covered it with common mould. The peas ſprouted well, ran up the codlin hedge to the height of about nine feet, ſhot out branches in ſeveral places, like vines, and bore ſo many well filled pods, that

that he judged he had above a buſhel from about three or fourſcore ſeeds.

He tried alſo an experiment on wheat infuſed in lime-water alone, ſome in brandy alone, and ſome in brandy and lime-water mixed, and had a great increaſe from each grain. With ſome of the liquor made with ſalt-petre, lime, and pigeons dung, he watered ſeveral trees in his garden, and found them grow and flouriſh much faſter than any other of the ſame kind which were not watered in that manner. He alſo ſteeped barley in the ſame liquor, and found it's increaſe equal to that of wheat.

Whether there be, or be not, any kind of prolific efficacy in theſe, or any other ſteeps, of which great numbers are pompouſly recommended, and which proper experiments can beſt determine; they are at leaſt ſo far ſerviceable to the ſeed corn, that they clear it from filth, from many ſeeds of weeds, and from ſuch poor light and diſtempered grains as are not fit for ſowing, and prepare it in ſuch a manner, that, being already well moiſtened, it will ſhift much better than abſolutely dry grain, in caſe a drought ſhould enſue after it is ſowed.

This thorough cleanſing of the ſeed may probably be, in a great meaſure, the reaſon why corn ſo prepared is leaſt apt to produce ſmutty ears. All the lyes generally made uſe of, certainly preſerve the plants from mouldineſs, and that in which lime is a principal ingredient ſeems to be one of the moſt effectual. But as this part naturally leads to the *Diſtempers of Corn*, another very intricate, but highly intereſting ſubject, I ſhall reſume it under that head, to which it properly belongs; and give in the mean time M. Duhamel's farther opinion concerning the pretended prolific virtues of infuſions, with ſome late experiments relative thereto, as delivered in the ſixth volume

of

of his excellent Treatiſe on the Culture of Land, publiſhed laſt year.

" We liſten readily to the marvellous, eſpecially " when it promiſes any great and ſingular advan- " tage. Such was the abbé de Vallemont's pro- " lific liquor, by means of which the huſbandman " was to reap vaſt crops, without manuring, or " ſcarcely plowing, his land. He was only to " ſoak his ſeed in this admirable liquid, which " was to open, ſtrengthen, and amazingly ferti- " lize the germe. Improbable as this doctrine " is, it was greedily received. — It is known, that " a ſeed contains in that part of it which is called " *the germe* or bud, the embryo of a plant, that " is to ſay, a plant in miniature, and that the reſt " of the ſeed ſerves to feed the young plant, or " plantule, till it acquires roots which draw its " farther nouriſhment from the earth. As ſoon " as theſe roots ſpread, the ſeed is exhauſted, and " there remains only its then uſeleſs huſk. What " benefit then can be derived from prolific liquors? " Perhaps they may render the nutritive ſubſtance " of the ſeed fitter to ſupport the young plant, " which, in conſequence thereof, may appear " ſomewhat more vigorous at firſt, and till it " has ſtruck out roots: but from the time of its " producing thoſe roots, it ceaſes to ſubſiſt upon " the lobes of the ſeed. Can it be imagined that " a ſingle atom of any prolific liquor exiſts at " the diſtance of four or ſix inches from the plant, " in the earth, where its roots are ſpread, and " from whence they draw their ſubſiſtance? Yet, " ſuch is the fondneſs of men for projects of this " kind, de Vallemont's mixture was extolled as " a wonderful diſcovery, indued with a magnetic " virtue capable of attracting from the boſom of the " air certain principles, which probably do not exiſt

" in

" in it, and numbers of receipts have been de-
" viſed for making prolific liquors. Writers upon
" agriculture have ſtuffed their books with them,
" and vaunted their miraculous effects. A deſire
" to ſee theſe mighty promiſes fulfilled, paved
" the way for their reception, and ill made expe-
" riments have given a ſanction to the error."

" A little corn, impregnated with theſe pre-
" tended prolific liquors, has been planted grain
" by grain in a garden, and its extraordinary in-
" creaſe has immediately been imputed to the
" ſteep. I myſelf was deceived by ſuch trials:
" but when I extended them to three or four
" acres of ground, this great fertility no longer
" took place, and I began to doubt the effi-
" cacy of theſe boaſted ſpecifics. About the
" ſame time, I ſaw a ſingle grain of barley pro-
" duce 230 ſtalks*, without any preparation,

* The fact is thus related by M. Duhamel in the ſecond Volume of his *Culture des Terres*, *p.* 20.

" A farmer at Acou, obſerving that the chief hopes of more than common ſucceſs by means of the new huſbandry, are founded on the frequent ſtirring of the ground while the corn grows, and on allowing each plant a ſufficient ſpace to extend its roots, and thereby collect the more nouriſhment; tried an experiment which ſeemed to him very proper to diſcover whether the effect would anſwer.

A grain of barley had been dropped accidentally in his vineyard, where it took root and grew. This plant, ſaid he, ſtands diſtant from any other, and can extend its roots every way; it is in a rich ſoil, and cannot want for food; therefore, according to the principles of the new huſbandry, it ought to yield a great increaſe, if frequent culture be added to theſe advantages. He reaſoned juſtly, as the event proved: for this ſingle grain of barley produced two hundred ears, and about thirty ſtalks which had no ears. Some of the ſtalks were four feet high, and moſt of them three. M. Duhamel counted twenty-four grains in a middling ear. Thus one grain, planted in a good ſoil, and well cultivated, produced 4800 grains; and the ſtraw of this ſingle plant of barley makes of itſelf a ſheaf, which is now in M. Duhamel's poſſeſſion.

and

" and was informed by the reverend Dr. Hales, " that another grain of barley had in like man- " ner, produced 154 ears *. From hence I con- " cluded, that the prodigies of vegetation ſo much " vaunted by ſome writers, as the effect of their " favourite infuſions, have in fact been owing to " the nature of the ſoil, to good culture, and to " the grains being at ſuch diſtances from each " other, that their roots have had room to ſpread, " and thereby collect a great quantity of food. " I then had recourſe to new experiments, which " confirmed me in this opinion."

" We ſee in the *political ſtate of England* [b], that " a grain of wheat which grew by chance in a " bed of onions, and had not received any pre- " paration, produced 5600 grains. Upon which " the author of that work remarks (as indeed I " had done before in regard to the former of the " above-mentioned productions), *that we muſt " not from thence infer that the country where ſuch a " thing happens is naturally more fertile than another, " or the method of agriculture commonly practiſed in " it better than elſewhere; for that the cauſe of theſe " prodigious growths is, that the grains ſtand ſingle " and in a good ſoil; that the only conſequence which " can be drawn from thence, is that the new huſ- " bandry comes neareſt to that ſtate in which theſe " ſurpriſing growths are produced; that it certainly " muſt increaſe the product of the crops; and that it " will probably require leſs ſeed than is uſed in the " common way.*

* " A grain of barley which Mr. Hallier planted in his garden in the year 1720, produced 154 ears, which contained 3300 grains. Theſe he ſowed the next year, three inches aſunder, and they yielded ſomewhat more than a buſhel; which, being ſowed again, produced, the third year, forty-five buſhels and a quarter."

[b] *Tom.* VIII. *year* 1758.

" Though

"Though it was pretty well proved by our "experiments, that good culture and proper "manures contribute more effectually to the in-"creaſe of crops, than all the boaſted prolific "liquors; yet ſeveral perſons, out of zeal for the "public good, have publiſhed, ſome the advan-"tages which they think ariſe from the uſe of "certain fertilizing ſteeps, and others, receipts "for making them."

"In this ſpirit, M. de la Jutais has given us a "little tract entitled, *The true Philoſopher's Stone*, "according to which, an admirable prolific liquor "is to be thus made. *Fuſe ſome nitre in an iron "veſſel; and when it is hot enough to burn the ſub-"ſtances which are to be added, throw in a ſmall "quantity of the ſame kind of ſeed as you intend to "ſow: for example, if you would have a prolific "liquor for wheat, throw a little wheat upon the "nitre; if turnips, put in turnip ſeed, and ſo on. "Theſe ſeeds take fire, are conſumed, and incorporate "with the melted nitre. Your prolific liquor is then "made, and you have only to mix the nitre with "water.* What reſults from this operation? No-"thing more, than that there is in this prolific "liquor a great deal of nitre with a ſmall portion "of fixed nitre, or alkaline ſalt: whether this "nitre be fixed with wheat, barley, turnip ſeed, "or powder of coal, all chymiſts allow that the "reſult will be the ſame, and that the ſame "liquor might be made by mixing a little alka-"line ſalt with a ſtrong ſolution of ſalt-petre. "The queſtion is, what effect it will have upon "vegetables. To try this fairly, two exactly "ſimilar fields ſhould be ſowed, the one with "wheat prepared with the prolific elixir, and the "other with wheat only limed in the uſual way; "taking care to ſow an equal quantity in each "field: for the ſingle circumſtance of diminiſh-

" ing the quantity of the ſeed, may increaſe the " crops in years when the corn does not tillet " much, and in good ſoils. Many have been de- " ceived by not attending to this circumſtance. " The following are well made experiments."

" M. Delu, after trying M. de la Jutais's eſ- " ſence three times, with the moſt ſcrupulous " care and exactneſs, thinks it of no ſort of " ſervice.

" M. Peirol, whom I mentioned before, com- " municated to me in 1755, ſeveral experiments " which he had made with great care, in order to " ſatisfy himſelf whether theſe prolific liquors have " any virtue; and thoſe trials made him then hope " for ſucceſs. I thanked him for his obliging " letters, and exhorted him to repeat the ſame " experiments with ſome new precautions which I " thought important. He did ſo, with all poſ- " ſible care; and it is with real pleaſure that I " ſhall give a juſt account of them, becauſe they " ſeem to me extremely fit to diſſuade thoſe who " wiſh well to agricultre, from putting their truſt " in ſuch illuſions. Inſtead of running after an " empty ſhadow, they may employ their time in " uſeful perquiſitions, by which the public will be " benefited."

" M. Peirol ſowed, both in his own garden, " and in that of the intendant of Auvergne, " 1, many-eared wheat; 2, rath-ripe barley; " 3, the common red wheat of the country; and " had from each of them an amazing increaſe."

" Each plant of the many-eared wheat had " from 50 to 92 ſtalks, and theſe laſt yielded " 13800 grains."

" Some of the rath-ripe barley had 244 ſtalks " to each plant, and yielded 14640 grains."

" Several plants of the red wheat had 300 " ſtalks; but the grains were eaten by birds."

" Theſe

"These were fine productions: but the moſt "important thing to be obſerved here, is that "M. Peirol ſowed all theſe different kinds of "grain, as well in his own garden, as in that "of the intendant, on the ſame day, *viz.* the "8th of September 1756; part of this corn hav-"ing been ſteeped in the abbé de Vallemont's fer-"tilizing liquor, while the reſt had not been infuſ-"ed at all: yet their productions were quite alike, "the ground had been prepared exactly in the "ſame manner for the ſteeped and the un-ſteeped "grain, and both were equally watered from time "to time with that prolific waſh. This laſt cir-"cumſtance ſpoils the whole experiment: for who "can doubt but that this watering of the plants "with impregnations of dung, muſt give them "great vigour; even more than a conſiderable "quantity of dung itſelf would have done? How-"ever, the following experiment is, luckily, "without that fault."

"On the 4th of April 1757, M. Peirol di-"vided a pretty large field into five equal parts. "The ground was in good tilth, and he ſowed it "with barley."

"The firſt part was ſowed with unſteeped bar-"ley, in rows a foot aſunder."

"The ſecond was ſowed with the ſame kind of "barley ſteeped in de Vallemont's liquor, and "likewiſe in rows a foot aſunder. Both had a "plowing between the rows, towards the end of "April."

"The third was ſowed in broad-caſt according "to the cuſtom of the country, excepting that a "quarter part of the uſual quantity of ſeed was "retrenched: but ſtill it was the ſame ſort of "barley, and this had been ſteeped in de Valle-"mont's liquor."

" The fourth diviſion was alſo ſowed in broad-
" caſt, like the former ; with this only difference,
" that the ſeed was ſteeped in a prolific liquor in-
" vented by M. Robineau."

" Laſtly, the fifth part was ſowed intirely in
" the common way, with the uſual quantity of
" the ſame kind of ſeed, un-ſteeped."

" The following was the ſtate of theſe five divi-
" ſions at harveſt time."

" The firſt and ſecond, which had been ſowed
" in rows, with only a quarter part of the quan-
" tity of ſeed generally uſed in the common way,
" but prepared for the one by being infuſed in de
" Vallemont's liquor, and ſowed in the other
" without any impregnation, were both very fine,
" and yielded a great deal of grain."

" The third and fourth, which had been ſowed
" in broad-caſt, with an abatement of only a
" quarter part of the uſual quantity of ſeed, and
" where the grain for one had been ſteeped in de
" Vallemont's liquor, and that for the other in
" M. Robineau's, were middling, and not viſibly
" different in any reſpect."

" The fifth ſpot, which had been ſowed intirely
" in the common way, and with the uſual quan-
" tity of ſeed, was the worſt of all."

" Though M. Peirol was prejudiced in favour
" of prolific eſſences, he nevertheleſs concludes
" from this experiment, 1, That the un-ſteeped
" grain uſed for the firſt mentioned portion of
" the field, having yielded as fine a crop as
" that of the ſecond which was ſteeped, infuſing
" the ſeed does not contribute much to make the
" plant's tiller."

" 2, That the products of the third and fourth
" diviſions being quite alike, M. Robineau's
" ſteep is not better than de Vallemont's."

" 3, That

" 3, That the difference between the crop of " the fifth, and thoſe of the third and fourth " pieces of ground, was probably owing to the " different quantity of ſeed."

" 4, That the ſuperior beauty of the firſt and " ſecond, which ſurpaſſed all the reſt, was occa- " ſioned by the grains being ſo far diſtant from " each other, that the roots of the plants had ſuf- " ficient room to collect their food, and that the " huſbandman was enabled to ſtir the ground be- " tween the rows, in the ſpring, by which the " vigour of the plants was conſiderably increaſed. " All this confirms the advantages of the new " huſbandry; and Mr. Peirol is ſo convinced of " it, that he has ſowed a very large tract of land, " near Riom, in the ſame manner as the two firſt " parts of the above-mentioned experiment."

" He has likewiſe made another trial of de " Vallemont's ſpecific, by planting vines in two " different places. In one of theſe, where the " ſoil was good, the common practice was fol- " lowed, and the cuttings ſprouted ſoon: in the " other, where the ground was leſs good, each " cutting was watered with two quarts of de Val- " mont's liquor. Theſe laſt ſhot out later, but " then grew with great ſtrength, and retained " their leaves a long while. It cannot be doubted " but that an infuſion of dung will invigorate " plants, and make them grow faſter than they " would otherwiſe. The owners of vineyards are " here to conſider, whether the expence of people " to do this buſineſs may not be greater than the " advantages accruing from it will repay: but it " is certain that by thus watering their newly " planted cuttings, eſpecially with a ſtrong infu- " ſion of dung, they will ſecure their taking " root."

"To ſatisfy myſelf in regard to M. Robineau's "petended prolific liquor, I choſe a piece of "ground laid out for wheat, and divided it into "three equal parts. One of theſe was ſowed in "the common way, with ſeeds only limed, and "produced 192 ſheaves to the acre, which yielded "60 buſhels of corn. Another was likewiſe ſowed "in the common way, with ſeed only limed, but "two fifths leſs in quantity than is generally uſed, "and produced 168 ſheaves, which yeilded 54 "buſhels. The third part was ſowed with the "ſame quantity of ſeed as the firſt, but prepared "according to M. Robineau's direction. This "produoed 156 ſheaves, which yielded 54 buſhels "of grain. From whence it follows, that his "method was not of any ſervice to the crop."

"His liquor, when diſtilled over a very ſlow "fire, yields a little brandy; what remains in the "matraſs, yields a great quantity of ſalt-petre, and "the reſidue is a bitter water which contains a "ſmall portion of alkaline ſalt. This is nearly "what would be obtained from de la Jutais's "liquor."

"M. Vandusfel has alſo tried M. Robineau's "prolific liquor, and found it attended with no "other effect, than that the field where it was "uſed had ſomewhat fewer ſmutty ears than other "grounds for which the ſeed had not been ſo "prepared. But other ſeed which he ſteeped in "an infuſion of dung, aſhes, and lime, produced "corn totally exempt from ſmut."

ARTI-

ARTICLE III.

Of the Time of ſowing.

WRITERS of different countries mention the uſual ſeaſons for ſowing their ſeveral kinds of grain, but do not take notice of any ſign by which the huſbandman may be directed when to ſow his corn with the greater chance of ſucceſs. For a rule of this kind we are indebted to the juſtly celebrated Linnæus, a man truly great, not only for his unequalled knowledge in natural hiſtory, and his indefatigable induſtry in the purſuit of that ſcience; but even ſtill more ſo for his diſintereſted zeal to turn the reſult of his ſtudies to the advantage of his country. Far ſuperior to that mean jealouſy which little minds are apt to entertain on their diſcoveries, he nobly calls forth every aſſiſtant, and invites each of them to become his rival in promoting the general welfare of mankind, as we are particularly informed by one of his diſciples.

"It is now the fourth year, ſays the ingenious Mr. Harald Barck *, ſince our illuſtrious preſident exhorted his countrymen to obſerve with all care and diligence, at what time every tree expands it's buds, and unfolds it's leaves; imagining, and not without good reaſon, that our country would, ſome time or other, reap ſome new, and perhaps unexpected benefit, from obſervations of this kind made in different places."

As one of the apparent advantages, he adviſes "the prudent huſbandman to watch with the greateſt care the proper time for ſowing; becauſe

* In his diſſertation *on the Foliation of Trees*, preſented to the Univerſity of Upſal on the third of May 1753 [a].

[a] *Amœn. Acad. Tom.* III.

this, with the divine aſſiſtance, produces plenty of proviſion, and lays the foundation of the public welfare of the ſtate, and of the private happineſs of the people. The ignorant farmer, tenacious of the ways and cuſtoms of his anceſtors, fixes his ſowing ſeaſon generally to a month, and ſometimes even to a particular day, without conſidering whether the earth be prepared to receive the ſeed: from whence it frequently happens, that the fields do not return what might be expected, and that what the ſower ſowed with ſweat, the reaper reaps with ſorrow. The wiſe oeconomiſt ſhould therefore fix certain ſigns whereby to judge of the proper time for ſowing. We look up to the ſtars, and, without reaſon, ſuppoſe that the changes on earth will anſwer to the heavenly bodies; entirely neglecting the things which grow around us. We ſee trees open their buds and expand their leaves, from whence we conclude that ſpring approaches, and experience ſupports us in this concluſion: but no body has hitherto been able to ſhew what trees Providence intended ſhould be our calendar, ſo that we might know on what day the countryman ought to ſow his grain. No one can deny but that the ſame power which brings forth the leaves of trees, will alſo make the grain vegetate; nor can any one juſtly aſſert that a premature ſowing will always, and every where, accelerate a ripe harveſt. Perhaps therefore we cannot promiſe ourſelves a happy ſucceſs by any means ſo likely, as by taking our rule for ſowing from the leafing of trees. We muſt, for this end, obſerve in what order every tree puts forth it's leaves, according to it's ſpecies, the heat of the atmoſphere and the quality of the ſoil. Afterwards, by comparing together the obſervations of ſeveral years, it will not be difficult to define, from the foliation of trees, if not certainly, at leaſt probably, the

time

Seed-time

time when annual plants ought to be ſown †. It will be neceſſary likewiſe to remark what ſowings made in different parts of the ſpring produce the beſt crops, that by comparing theſe with the leafing of trees, it may appear which is the moſt proper time for ſowing: nor will it be amiſs in like manner to note at what times certain plants, eſpecially the moſt remarkable in every province, blow; that it may appear whether the year makes a quicker or ſlower progreſs. In Upland, the ſowing of barley nearly coincides with the foliation of the birch."

Mr. Stillingfleet, who has given us a judicious tranſlation of ſome ſelect pieces publiſhed by ſeveral ingenious members of that great, and hitherto unrivalled ſchool of natural hiſtory, the uni-

† The method here pointed out well deſerves the moſt ſerious attention of every good patriot. A ſeries of obſervations of this kind, properly made by intelligent perſons, in different parts, and afterwards rightly compared and combined, would ſoon afford almoſt infallible rules to guide the huſbandman in one of the moſt important parts of agriculture. I cannot too ſtrongly recommend it to the public ſpirited inhabitants of the Britiſh dominions in particular, as a means by which the power and opulence of this happy ſtate cannot fail to be conſiderably increaſed, and the felicity of individuals to be conſequently confirmed.

The principal points which Mr. Barck thinks neceſſary in theſe obſervations are, 1ſt, That they be continued for *three years*, and that the *time* and *place* of obſervation be particularly ſpecified. 2dly, That they be made on the ſame *ſubjects*: and 3dly, That the *ſoil* and *expoſition* be carefully noticed and deſcribed, in order to their being duly compared with the field which is to be ſown. The neceſſity of being as exact as poſſible in this laſt article, will appear to every one who does but conſider, what all know, that the *north wind*, *ſhade*, and a *moiſt ſoil* hinder the leafing of trees, as much as a *dry ſituation* on the *ſlope* of a hill inclining to the *ſouth* promotes it. — Another circumſtance which would greatly facilitate the application of theſe obſervations, is, to take the trees in their progreſſive order of leafing: for nature is always regular, and the guide would then be ſure.

S

verſity

verſity of Upſal in Sweden, under the preſidence of the excellent Linnæus, was told by a common huſbandman in Norfolk, that when the oak catkins begin to ſhed their ſeed, it is a proper time to ſow barley: "and why" adds he, very properly, "may not ſome other trees ſerve to direct "the farmer as to other ſeeds. The prudent "gardener never ventures to put his houſe plants "out, till the mulberry leaf is of a certain "growth." Heſiod, continues this gentleman in his ingenious note on M. Barck's Foliation of Trees[a], began to fix the proper ſeaſons for plowing, ſowing, &c. by the appearance of birds of paſſage, or of inſects, or by the flowering of plants; but I do not find that this method was ever after attended to till Linnæus wrote. Heſiod ſays, that when the voice of the crane is heard over-head, then is the time for plowing; that if it ſhould happen to rain three days together when the cuckow ſings, late ſowing will then be as good as early ſowing; that when ſnails begin to creep out of their holes, and climb up the plants, it is time to leave off digging about vines and take to pruning. There is a wonderful coincidence, which probably takes place in all countries, between vegetation and the arrival of certain birds of paſſage. Linnæus ſays, that the *wood-anemone* (in Sweden) blows from the arrival of the *ſwallow:* and Mr. Stillingfleet finds by a diary which he kept in Norfolk for the year 1755, that the *ſwallow* appeared there on the 6th of April, and the *wood-anemone* was in bloom on the 10th of the ſame month. Linnæus obſerves, that the *marſh-marygold* blows when the *cuckow* ſings; and Mr. Stillingfleet finds by his diary, that the *marſh-mary-*

[a] *Miſcellaneous Tracts, p.* 147.

gold was in bloſſom on the 7th of April, and the *cuckow* ſung the ſame day.

A due temperature of the ſeaſon, with reſpect to heat or cold, drought or wet, for all theſe greatly influence the ſtate of the earth, is eſſentially neceſſary, and ſhould be carefully attended to by the huſbandman when he ſows: but the preciſe time moſt proper for this work, cannot, by any means, be invariably fixed, becauſe it will always depend on the concurrence of a variety of circumſtances. The ſeaſons are more or leſs forward, and the ground is more or leſs dry, in ſome years, than in others. A proper ſeries of well made obſervations would furniſh the beſt of rules in this reſpect, but certainly would not fix the time of ſowing to any particular day, or week, for years to come. Linnæus's method, of carefully obſerving the foliation of trees, &c. would determine the proper times for ſpring ſowing; and Pliny, after mentioning the ſeveral conſtellations by which farmers were guided in his time, inſtructs the huſbandman with regard to autumnal ſowing, upon a principle ſimiliar to that of our great modern naturaliſt. "Why," ſays he[b], "does "the huſbandman look up to the ſtars, of which "he is ignorant, whilſt every hedge and tree point "out the ſeaſon by the fall of their leaves? This "circumſtance will indicate the temperature of "the air in every climate, and ſhew whether the "ſeaſon be early or late. This conſtitutes an "univerſal rule for the whole world; becauſe "trees ſhed their leaves in every country accord-"ing to the difference of the ſeaſons. This "gives a general ſignal for ſowing; nature de-"claring, that ſhe has then covered the earth

b *Lib.* XVIII. *c.* 25.

againſt

" againſt the inclemency of the winter, and en-
" riched it with this manure."

I therefore can only ſay, in general, that it is better to ſow early, than too late, provided the ſeaſon will admit of it; becauſe the plants are better able to reſiſt the ſeverity of the winter, after they have acquired a certain degree of ſtrength; and their roots being then longer, and conſequently better fixed in the earth, they will be leſs liable to be thrown out by froſt. For this reaſon, in particular, perhaps the colder the climate is, the earlier the wheat ſhould be ſowed. Some lands are of ſuch a nature, that they ſwell greatly in hard froſts, and, ſubſiding again upon a thaw, leave the roots of plants quite bare upon their ſurface. There have, indeed, been years in which fields ſowed very late, for inſtance in December, have done extremely well: but that ought not, on any account, to be made a rule; experience ſhewing that ſuch late ſowings very ſeldom anſwer. On the other hand, the corn is likewiſe expoſed to many dangers when ſowed too early: for the ſtalks which ſhoot up before winter cannot well bear hard froſts, though wheat would not be hurt by them when only in the blade.

M. de Chateauvieux, than whom we cannot have a better guide, is clearly of opinion, that, though the proper time of the year for ſowing be come, the corn ſhould not be put into the ground if the temperature of the ſeaſon be not favourable, and that, on the contrary, the ſowing of it ought to be deferred, in hopes of a change. " If, ſays he[c], " the weather is very hot, and the earth extremely " dry, it will be abſolutely neceſſary to wait till " ſome rain has fallen; for otherwiſe the ſeed will " riſe but very imperfectly. This I am ſure of, by

[c] *Culture de Terres, Tom.* IV. *p.* 407.

" ſeveral

"several experiments which I have made, and "which contradict the common saying of some "farmers, that *the earth is the best granary to keep "the corn in.* Full of this notion, whenever the "stated time comes round, they sow without "distinction, in wet land or in dry: even heat "does not hinder them: they think their seed "will certainly sprout well after the first rain: "but I have always experienced that the plants "have come up thin.".

"To satisfy myself still farther in this point, I "tried an experiment, purposely to know whether "corn can be sowed, with any reasonable expec-"tation of success, when the whether is very hot, "and the earth very dry. Upon reading M. Du-"hamel du Monceau's excellent treatise on the "preservation of corn, I observed, that he had "found by his experiments, that wheat dried in a "stove heated to 60 degrees of M. de Réaumur's "thermometer, had lost it's faculty of growing. "From thence I conjectured, that wheat which "should undergo a heat, for example, of 30 de-"grees, during a longer time, would be equally "parched up, and rendered incapable of vegetat-"ing. I considered the earth, when hot and dry, "as a kind of stove, in which the seed, if it re-"main too long without receiving any moisture, "may become so dry, that the greatest part of it "will never be able to sprout. This reasoning is "just and I therefore determined to have recourse "to that trusty guide, experience."

"On the 18th of July, 1754, at four o'clock "in the afternoon, I placed M. de Réaumur's "thermometer two inches deep in the earth, and "screened it from the immediate impression of "the rays of the sun. The liquor rose to the 31st "degree, which shewed me the heat of the earth.

"The

"The thermometer being afterwards expoſed "to the ſun, the liquor roſe to 36 degrees."

"The ſame day, I ſowed 80 grains of wheat in "this ground. The heat continued nearly the "ſame during the reſt of that month, and almoſt "all Auguſt. On the 31ſt of July, only 10 grains "had ſhot up, and on the 16th of Auguſt there "were in all 16; after which, not one more roſe: "conſequently 64 grains out of the 80 never "ſprouted at all *".

"On the 28th of July I ſowed 50 grains. Only "four of them roſe by the 16th of Auguſt, and "not one after. Here were again 46 grains "which did not grow at all."

"The ſame day, I ſowed 60 grains in another "place. On the 16th of Auguſt only ſix grains "had ſprouted, and not one plant more ever ap-"peared after: conſequently here too were 54 "grains which never grew. All theſe grains "were ſowed in my garden, in exceeding good "mould."

"I was ſure that the wheat which I ſowed was "perfectly ſound, and in every reſpect capable of "growing. It was therefore quite clear, that ſo "great a number of grains out of the whole, "which did not ſprout at all, had loſt the faculty of "growing, by their being parched up by the heat "and dryneſs of the earth. To be ſtill more "certain of this, three weeks after I had ſowed "theſe grains, I watered half of them ſeveral "times; but to no purpoſe: not one of them "roſe, and I found ſeveral of them quite whole in "the earth where I had ſowed them."

* M. Duhamel obſerves, that wheat has, however been known to riſe very well after having remained ſix weeks or two months in the earth. Perhaps the circumſtances were different.

"After

"After this experiment, on the 11th of Auguſt I ſuſpended the ſowings I had begun on the 8th, and did not reſume them till the 26th, after ſome rain which fell on the 22d and 23d. These laſt ſowings roſe much better than the firſt."

Upon the whole, M. de Chateauvieux concludes from his own repeated practice, that the beſt time for ſowing in ſuch a climate as Geneva (which differs very little from ours), is, from the 20th of Auguſt to the end of September; and thinks that even the firſt fortnight in October may be taken in, if the land cannot poſſibly be ſowed ſooner. But he allows of this only in a caſe of neceſſity, and judges that, rather than ſow later, it is beſt to ſtay till ſpring.

"Thus, ſays he, it is that experience and obſervation teach us to leave off bad cuſtoms, or ſuch as are not founded on principles with which a man of ſenſe can reſt ſatisfied."

ARTICLE IV.

Of the manner of Sowing.

IT is of the greateſt conſequence to farmers that every ſeed be placed in the earth at a proper depth, and in the beſt manner: but experiments are yet wanting to determine with due exactneſs, what is the depth which beſt ſuits each kind of grain, in different ſoils.

The method which Mr. Tull propoſes, is a very good and eaſy way to aſcertain this point for each particular ſowing. Take, ſays he, twelve ſticks, or gauges; bore a hole in one at the diſtance of half an inch from the end, in the ſecond at an inch, and ſo on, increaſing half an inch to each

of

of the twelve. Drive a peg into each of theſe holes: then, in the ſame ſort of ground as you intend to plant, make a row of twenty holes with the half inch gauge; put therein twenty good ſeeds; cover them up, and ſtick the gauge at the end of that row; then do the like with all the other eleven gauges. This will determine the depth at which moſt ſeeds will come up; and the drill, if that inſtrument be uſed for the ſowing, muſt be ſet accordingly.

Upon the ſame principle, M. Duhamel[a] dug a trench twelve feet long, ſloping it gradually from the ſurface at one end, to the depth of two feet at the other. He then ſowed different ſeeds in this trench, and, having put the earth in its former place, obſerved, 1, That hardly any ſeeds riſe when buried deeper than nine inches: 2, That ſome ſeeds riſe extremely well at the depth of ſix inches; and 3, That other ſeeds do not riſe at all when they are above one or two inches deep. Experience ſhews, that the ſame ſeeds may be ſowed deeper in a light, than in a heavy ſoil; that grains which lie too deep in the earth to ſpring up in a dry year, may riſe in a warm and moiſt ſeaſon; and that others which are buried ſtill deeper in the ground, will ſometimes remain there ſound and unaltered for ten or twenty years, at the end of which they will grow extremely well, and produce their proper plants, if they chance to be brought to the ſurface, by moving the earth, as was mentioned before[b].

The uſual way of ſowing in broad caſt cannot anſwer all the intentions of placing the ſeed properly in the earth, and muſt be attended with ſeveral inconveniencies; ſuch as, the ſeed's becoming the prey of various birds and animals;

[a] *Culture des Terres, Tom.* I. *p.* 125. [b] *p.* 285.

it's

it's being laid ſo ſuperficially, that the ſun often parches it up, or a long continued rain, inſtead of promoting a kindly vegetation, ſoaks into the grains and burſts them; the ſeed is very unequally ſowed, becauſe of the inequality of the handfuls which different ſowers graſp: and great part of it neceſſarily falls together into hollows, where the ſurface of the ground is at all unequal, &c.

Senſible of theſe diſadvantages, farmers have, eſpecially for their winter grain, adopted the method of ſowing under furrow, that is, ſowing one half of the ſeed in broad caſt, and then plowing it in, and afterwards ſowing the other half, which is covered by harrowing. But this method is alſo liable to almoſt as many objections as the other: for the quantity ſown in each particular ſpot, and the equal diſtribution which ought to take place throughout the whole, cannot but be even more uncertain than in the broad caſt way, where the whole is ſowed at once; nor dares the farmer, in this ſowing under furrow, to omit ſowing the ſecond quantity, leſt great part of what has been plowed down be buried ſo deep that it cannot riſe, eſpecially if the ſoil is at all ſtrong.——Another general fault in the common ways of ſowing, is, that too much ſeed is employed; partly, becauſe cuſtom has eſtabliſhed a kind of rule in that reſpect, and partly on account of the allowance which it is neceſſary to make for what the birds eat, and for what lies too deep ever to riſe; circumſtances by which a very great quantity of corn is abſolutely loſt.

Theſe inconveniencies are prevented by the drill, which, 1, drops the ſeed at whatever depth and diſtance experience has ſhewn to be fitteſt for the particular kind which is ſowed; 2, fills all the furrows with earth, ſo that none of the grain remains uncovered; and 3, lets fall into each fur-

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Senſible of theſe diſadvantages, farmers have, eſpecially for their winter grain, adopted the method of ſowing under furrow, that is, ſowing one half of the ſeed in broad caſt, and then plowing it in, and afterwards ſowing the other half, which is covered by harrowing. But this method is alſo liable to almoſt as many objections as the other: for the quantity ſown in each particular ſpot, and the equal diſtribution which ought to take place throughout the whole, cannot but be even more uncertain than in the broad caſt way, where the whole is ſowed at once; nor dares the farmer, in this ſowing under furrow, to omit ſowing the ſecond quantity, leſt great part of what has been plowed down be buried ſo deep that it cannot riſe, eſpecially if the ſoil is at all ſtrong.——Another general fault in the common ways of ſowing, is, that too much ſeed is employed; partly, becauſe cuſtom has eſtabliſhed a kind of rule in that reſpect, and partly on account of the allowance which it is neceſſary to make for what the birds eat, and for what lies too deep ever to riſe; circumſtances by which a very great quantity of corn is abſolutely loſt.

Theſe inconveniencies are prevented by the drill, which, 1, drops the ſeed at whatever depth and diſtance experience has ſhewn to be fitteſt for the particular kind which is ſowed; 2, fills all the furrows with earth, ſo that none of the grain remains uncovered; and 3, lets fall into each fur-

row the exact quantity of ſeed which has been found to be moſt proper. By this means every ſeed is ſo rightly placed in the earth, that we may be confident they will all do well, if they are not hurt by inſects. But as this inſtrument ſows only the abſolutely neceſſary quantity of ſeed, the huſbandman ought to be certain of the growth of every grain: becauſe it often happens, that part of the ſeed is imperfect and does not ſprout at all. As the eye cannot diſtinguiſh it's quality, he ſhould aſſure himſelf of it, by previouſly ſowing fifty or an hundred grains taken by chance, but exactly counted: when theſe ſpring up, the number of plants will ſhew what proportion is deficient, and the quantity of the ſeed ſhould be increaſed accordingly. To know what ſpace ſhould be left between each ſeed thus planted in the furrow, for that ſpace ought to be different according to the nature of the plant, it will be neceſſary to obſerve how much ground a ſtrong and vigorous plant of the ſame kind takes up when arrived at it's greateſt perfection, which it will moſt probably attain when cultivated according to the new huſbandry; and the drill may then be ſet ſo as to drop each grain at a due diſtance.

Beſides leaving ſtated diſtances between each of the ſeeds which the drill depoſits in the furrow, a farther eſſential object in the new huſbandry, is to leave proper ſpaces between the rows of corn, which, in this method, are ſowed with the greateſt regularity, nearer together, or farther aſunder, according to the nature of the plants intended to be cultivated. Some do beſt in ſingle rows, others in double, others again in triple rows, and others in quadruple; as will hereafter be more fully ſhewn by ſeveral experiments.

The two firſt inventions for ſowing in this manner, were Mr. Worlidge's drill-plough, and Don

Joſeph

Joſeph de Lucatello's *Sembrador*, both of which may claim the merit of being originals. As neither Mr. Tull, nor M. Duhamel, have taken any notice of Mr. Worlidge's drill, which, I am perſuaded, will fully anſwer all the ends he propoſes, I think it a juſtice due to one of the beſt writers on agriculture, to give his own account of this too little known, and too much neglected, inſtrument.

"Beſides the uſual manner of ſowing corn, "there are," ſays he, "ſeveral other ways of "diſperſing it, as by ſetting, and hoeing of it in, "&c. This art of ſetting corn ſeems to be very "ancient, as appears by Virgil, *Unguibus infodiunt et ipſis fruges.*——And hath been a long "time attempted to be brought into practice "again, as appears by Mr. Platt's *Adam's Tool revived.*" Mr. Worlidge then points out the defects in Mr. Platt's inſtruments, and proceeds thus.

"But to remedy and remove all manner of errors and inconveniencies that can be found in "ſetting of corn, I ſhall here give you a plain and "perfect deſcription of an eaſy and feaſible inſtrament that ſhall diſperſe your corn, grain, pulſe, "of what kind ſoever, at what diſtance, and in "what proportion you pleaſe to deſign, and that "with very great expedition, and very little extraordinary charge, expence, or hazard.

"Firſt, make a frame of timber, of about two "or three inches ſquare, the breadth of the frame "about two feet, the height about eighteen inches, "the length about four feet, more or leſs as you "pleaſe, as at *u u u u*, *Fig.* 1. *Plate* VII. Place this "frame on two pair of ordinary wheels, like plough-"wheels. The axle-tree of the two foremoſt "wheels is to lock on either ſide, as doth the fore

" axle-tree of a waggon, for reaſons hereafter
" ſhewn. The hindermoſt axle-tree, being of
" iron, and ſquare in the middle, muſt be fixed
" to the center of the wheels, that the axis and
" wheels may move together: then, about the
" middle of the frame, in the bottom, let there
" be fixed an iron inſtrument, or of wood pointed
" with iron, like unto a coulter, made a little
" ſpreading at the bottom, in the nature of a
" ſhare, made to paſs through two mortiſes on the
" top, for its greater ſtrength; and made alſo to
" be wedged higher or lower, according as you
" will have your furrow in depth, as at *o o*; the
" uſe whereof is only to make the furrow: ſo that
" you muſt make the point thereof of breadth
" only to move the earth, and caſt it, or force it,
" on either ſide, that the corn may fall to the
" bottom of the furrow. Then, over this ſhare,
" or coulter, a little behind it, may a wooden
" pipe be made, to come from the top of the
" frame to the lower end of the ſhare, tapering
" downward, as at *p*, and as near as you can to
" the ſhare: to deliver the corn immediately, as
" the ground is opened, and before any earth falls
" in; that what earth does afterwards fall in, may
" fall on the corn. This pipe is to proceed out
" of a large hopper fixed on the top of the frame,
" that may contain about a buſhel, as at *q*: but
" ſo that the corn may gradually deſcend, accord-
" ing to the quantity you intend to beſtow on an
" acre. At the very neck of the hopper, under-
" neath, in the ſquare hollow thereof, muſt be
" fitted in the edge of a wheel of wood, about half
" an inch thick, and proportioned to the cavity of
" the neck, as behind the letter *r*. The wheel
" need not be above two or three inches diameter,
" and fixed on an axis extending from one ſide of
" the frame to the other: on which axis is alſo to

" be

" be another wheel, with a groove on the circum-
" ference thereof, like the wheel of a ſpit or jack;
" as at *r*, which muſt anſwer to another wheel of
" the like nature and form, fixed on the axis of
" the hindermoſt of the wheels, as at *s*: then fit
" a line, (of ſilk is beſt, becauſe it will not be ſo
" apt to ſhrink and reach as hemp) about theſe two
" wheels, that when the inſtrument moves on the
" hindermoſt wheels, by the means of the line,
" the ſmall wheel at the neck of the hopper, may
" alſo move; which leſſer wheel in the neck of the
" hopper, may have ſhort pieces of thick leather
" fixed in the circumference thereof, like unto the
" teeth of a jack-wheel, that upon its motion it
" may deduce the corn out of the hopper, in what
" proportion you pleaſe: for in caſe it comes too
" faſt, then you may by a wedge at the tenon of
" the piece whereuon the hopper reſts, as at *t*,
" or at the end of the axis of the leſſer wheel,
" force the wheel and hopper together; as, in caſe
" it feeds too ſlow, then may you remove them
" by the ſame wedges to a farther diſtance; alſo
" in caſe your line be too ſlack or too hard, you
" may prevent either extreme by a wedge in the
" place where the axis of the wheel moves, or by
" a third wheel, about the middle of the line
" made to move farther or nearer, as you ſee
" cauſe.

" Alſo by means of the iron rod *v v*, fixed to
" the foremoſt axis that is made to lock, may
" you guide your engine at pleaſure; which rod
" is made crooked at the end of the hopper, leſt
" that ſhould injure its motion.

" And at the turning, you may lift up your
" engine by the handles at *x*: for whilſt you lift
" it up, the corn feeds not until you ſet the ſame
" down again.

"One horſe and one man may work with this "inſtrument, and ſow land as faſt or faſter than "ſix horſes can plough; ſo that you may with "eaſe compute the expence, in caſe your inſtru-"ment be ſingle: but you may in the ſame frame "have two ſhares at twelve inches diſtance, more "or leſs, as you will have the rows of corn diſ-"tant the one from the other; and two pipes out "of the ſame hopper, and two ſmall wheels on the "ſame axis, with other wheels anſwerable, every "whit as eaſy to be performed as one; and then "you may double your proportion of land in a "day."

"This inſtrument will always keep the ſame "proportion you firſt ſet it to, which you muſt "thus contrive. Firſt, know the length of the "furrow you ſow: then caſt up how many of "theſe furrows at ſuch diſtance your inſtrument "is made for (whether a foot, more or leſs), "will amount to an acre: then conclude how "much to ſow on an acre; as ſuppoſe a buſhel: "then divide that buſhel into ſo many parts "as you have furrows or diſtances in that acre: "then take one or two of thoſe parts, and put "into your hopper, and obſerve whether it will "hold out, or ſuperabound at the end of one "or two furrows, and accordingly proceed and "rectify the feeder: or you may judge by "your own reaſon, whether it feed too faſt or too "ſlow."

"In caſe it feeds too faſt, notwithſtanding "they be cloſe placed together, you may make "that wheel at the loweſt axis, wherein the line "moves, to be leſs than the upper; then will the "motion be ſlower; and thus may you make it "move as ſlow as you will, by augmenting "the upper, and diminiſhing the lower wheels

"wherein

" wherein the line is; and make it move faſter
" by the contrary rule.

" In caſe you drive apace, it feeds apace: in
" caſe you drive but ſlow, it feeds but ſlowly:
" here is no error.

" When you come to any turning at the lands
" end, by lifting up the hindermoſt part of the
" inſtrument, that thoſe wheels touch not the
" ground, the feeding of the corn immediately
" ceaſeth until you ſet it down again.

" Alſo all the corn you ſow lies at a certain
" depth, none too deep, nor any too ſhallow.

" You may place a kind of harrow to follow;
" but the beſt way is to have on each ſide of each
" furrow, a piece of wood, a little broad at the
" end, ſet aſlope to force the earth rounding on
" the corn. This may be well placed and fitted
" to the bottom of this inſtrument, juſt behind
" the ſhare and feeding pipe.

" By this method of ſowing any ſort of grain
" or pulſe, may be ſaved the one half, and
" in ſome places more, which by the other way
" is either buried ſo deep under clods, that it
" cannot come up, or elſe is ſo ſhallow, that the
" cold in the winter, or drought in the ſummer
" killeth it, or elſe lies on the ſurface as a prey to
" the fowls of the air: much alſo thereof falls in
" cluſters, twenty or thirty grains where one or
" two might ſuffice, which are common inconve-
" niences, and uſually happening to the vulgar
" way of ſowing corn: the greater half by far is
" loſt, which in all probability may be ſaved by the
" uſe of this very inſtrument, which will doubly
" requite the extraordinary charge and trouble
" thereof: for here is no corn ſowed under clods,
" but in rows, as the earth is ſtirred and moved;
" it is all at one certain depth and at one certain
" diſtance, and equally covered, below the injury

" of froſt, and heat, and rapine of birds. Alſo by " this way corn may be ſown in the very middle " or convenient depth of the mould, that it may " have the ſtrength of the land both below and " above the root; whilſt in the other more uſual " way, the corn falls to the bottom of the furrow " on the gravel, clay, or ſuch like hard ground, " where it ſeldom thrives ſo well as what hap- " pens to be in the midſt. This way alſo ex- " ceeds the way of *ſetting corn*, where the pins " thruſt into the ground harden and faſten the " mould, ſo that, unleſs the land be very light, it " confines the roots to too narrow a place, which " in this way is prevented; as I have obſerved in " garden beans, that thoſe hoed in, proved better " than thoſe ſet with a ſtick.

" By the uſe of this inſtrument alſo may you " cover your grain or pulſe with any rich com- " poſt you ſhall prepare for that purpoſe, either " with pigeon-dung dry or granulated, or any " other ſaline or lixivial ſubſtance, made diſper- " ſeable, which may drop after the corn, and prove " an excellent improvement: for we find experi- " mentally, that pig on's dung ſown by the hand " on wheat or barley, mightily advantageth it in " the common way of huſbandry; much more " then might we expect this way, where the dung, " or ſuch like ſubſtance is all in the ſame furrow " with the corn; whereas in the other vulgar " way, a great part thereof comes not near it.

" It may either be done by having another " hopper on the ſame frame behind that for the " corn, wherein the compoſt may be put, and " made to drop ſucceſſively after the corn: or it " may be ſown by another inſtrument to follow " the former, which is the better way, and may " both diſperſe the ſoil, and cover both ſoil and " ſeed.

" The

"The corn alſo thus ſown in ranges, you may "with much more conveniency go between, and "either weed it or hoe it, and earth it up as you "think good, and at harveſt it will eaſily repay "the charges.

"Alſo the fore-wheels being made to lock to "and fro on either ſide, you may have an upright "iron pin fixed to the middle of the axis, ex-"tended to the top of the frame: and from "thence a ſmall rod of iron to come to your hand, "with a crooked neck juſt againſt the neck of "the hopper; by means of which iron rod, you "may lock or turn the wheels either way, and "guide your inſtrument, and rectify it, if it de-"viate out of its right courſe.

"The hopper muſt be broad and ſhallow, that "the ſeed preſs not much harder when it is full, "than when it is near empty, leſt it ſow not pro-"portionably.

"Though this inſtrument may at firſt ſeem "myſterious and intricate to the ignorant, yet I "am confident it will anſwer to every particular "of what I have written. Any ingenious wheel-"wright, joiner, or carpenter, may eaſily make "it with very little inſtruction, and any ordinary "plowman may uſe it."

The chief inconvenience in this inſtrument ſeems to be, that the ſeed is liable to be bruiſed as it drops from the hopper, by the wheel in the neck of that hopper.

In the account which is given of the *Sembrador*, in the Philoſophical Tranſactions [d] it is juſtly obſerved, that the perfection of Agriculture conſiſts in ſetting the plants at proper diſtances, in ground well looſened to a ſufficient depth, that their roots may be able to ſpread, in order to collect the

[d] *No.* 60.

nouriſh-

nouriſhment which is neceſſary to produce and ripen their fruit. But this is ſo little obſerved, that almoſt all ſorts of ſeed are commonly ſown by handfuls at random; whence it happens, that corn is ſowed too thick in ſome places, too thin in others, and, frequently, the greater part of it is either not covered at all, or not deep enough; by which means it is not only expoſed to be eaten by birds, but alſo in cold countries to be ſpoiled by froſt, and in hot climates, by the ſun. To remedy theſe inconveniencies, Don Joſeph de Lucatello invented an inſtrument, which, being faſtened to the tail of the plough, drops the ſeed regularly in the furrow, ſaves four parts in five of the quantity which is generally uſed, and becomes the means of procuring a conſiderable increaſe, without employing a perſon purpoſely to ſow.

As a few words will explain the mechaniſm of this inſtrument, which has it's merit, though it has not been found to anſwer in common practice, I ſhall venture to give the following ſhort deſcription of it; becauſe ſome of the principles of this may poſſibly ſuggeſt a uſeful hint to an ingenious artiſt.

Fig. 2. *Plate* VII, is a box of wood: *a b c d* the cover of that part into which the corn is put, and which is open in *Fig.* 3, at *W*: *e f h g k l Fig.* 2. are the two ſides which cover that part of the box where the cylinder, which is ſtuck round with three rows of little ſpoons to throw out the grains, is turned round. Theſe ſides are taken off in *Fig.* 3, to ſhew the cylinder *R S*, and the ſpoons *x x x*. The internal ſhape of theſe ſides is expreſſed in *Fig.* 4, where may be ſeen the four triangular pieces *p p p p*, and the triangular interſtices *q q q*, which ſerve to convey the corn diſcharged by the ſpoons, to holes which let it out at the bottom of the box. *T*, is one of the wheels which turn the

cylinder;

cylinder; and *V* the other end of the cylinder, on which the other wheel is to be fixed. The furrow in which the grain has been dropt is to be covered by the next turn of the plough; to which end the mould-board muſt project conſiderably.

In uſing this inſtrument, according to Don Lucatello's method, it muſt be faſtened to the beam of the plough, at ſuch a height that the long projecting nails in the wheels may touch the ground ſufficiently to make them turn round, but not enough for the wheels to reſt upon it, and drag along without turning.

This way of turning the wheels, and conſequently the cylinder, muſt occaſion an unequal diſtribution of the ſeed, wherever the ground is rough or ſtony. For this reaſon, and on account of ſome other inconveniencies attending the uſe of it, the *Sembrador* is not an inſtrument to be recommended to farmers: but I would here refer to the conſideration of ſuch as are better ſkilled in theſe matters than I even pretend to be, whether an inſtrument leſs liable to this objection, or to the fault which is found in Mr. Worlidge's drill, may not be formed, by placing the ſeed-box of the ſembrador in a frame like that of Mr. Worlidge, with (inſtead of the wheels of the ſembrador, which turn upon the ground) two wheels, grooved like pullies, fixed upon the axis of the cylinder, to be turned with cords, like the ſmall wheel at the neck of Mr. Worlidge's hopper. A ſquare frame, like that, will keep the box more ſteady, and therefore render the diſcharge of the ſeed more regular, than it can be in Don Lucatello's manner.

M. Duhamel obſerves, that the drill-plough invented by M de Chateauvieux delivers the grain with the greateſt exactneſs, and therefore deſerves much commendation; but that the price of it

is too great for moſt farmers. His own, which I ſhall now deſcribe, has, for that reaſon, been the moſt generally uſed. I could wiſh that the limits of this work would permit me to give alſo a full deſcription of M. de Chateauvieux's drill; though I fear it would be too complex to be underſtood or made by common workmen, and, I doubt, too nice in many of its parts for the rough hands of common plowmen. I hope, however, that the ingenious and curious among my countrymen will not, on account of this omiſſion, be any ways induced not to conſult the original in M. Duhamel's work, or not to endeavour to execute what has been ſo well contrived by one of the greateſt geniuſes in agriculture that this age can boaſt of.

M. Duhamel's drill is faſtened to the fore-carriage of a common plough. The hind part conſiſts of a plank *S S*, *Fig.* 5. *Plate* VII, at leaſt three inches thick, which is called the table. Underneath this table, and to the bottom part of it, are ſtrongly fixed, as at *TTT*, three ſhares. The beam *I*, *I*, is faſtened to the fore part of the table: and the handles *L*, *L*, are let into mortiſes in the back part of the table, in which they are fixed. *a*, *a*, *a*, are three floped cavities cut in the table, to receive the ſeed from the cylinder, and convey it through a hole, about an inch in diameter, in the center of each of them, into the hollow *c*, at the back of the ſhare *Fig.* 6. The form of theſe cavities is more clearly expreſſed by *a*, *a*, *a*, *Fig.* 7. At *b*, *b*, *b*, *b*, *Fig.* 5. are fixed four ſtrong ſtandards, to hold the drill-box ſteady.

The ſhares *Fig.* 6, are made of wood, and terminate at the bottom of their fore part *a*, in a circular form, covered with iron. In their hind part *b* is a groove through which the ſeed drops to the bottom of the furrow. The ſeed is conveyed from the cavities *a*, *a*, *a*, *Fig.* 7, to this grove *b*,

Fig.

Fig. 6, by means of a thin plate of iron *c*, rounded and fixed to the ſhare, as at *d*. Theſe ſhares are about an inch and a half thick, and their height from *a* to *b* is at leaſt a foot.

As theſe ſhares terminate in a curve at bottom, if they meet with any roots, dung not thoroughly rotted, or any other ſubſtance which they cannot eaſily divide, they force it down to the bottom of the furrow, and by that means are never liable to be choaked: and to prevent this ſtill more effectually, the middle ſhare is placed ſomewhat more backward than the two others. It is likewiſe made ſhorter, when uſed in land laid out in ridges, in proportion to the greater height of the middle of the ridges. The ſhares are generally ſeven inches aſunder.

The four ſtandards *b*, *b*, *b*, *b*, *Fig.* 5 and 7, are placed in ſuch a manner, that the blocks *n*, *n*, *Fig.* 8, in which a groove is cut, anſwer to the middle of this table. On an iron axle-tree which anſwers to the wheels, and which paſſes through the centre of the blocks, is fixed the cylinder, or barrel *o*, *o*, which is cloſed at its ends, *p*, *s*, and is likewiſe divided by two partitions *q*, *r*. This barrel is made of thin ſplit deal, as are alſo the ends and partitions. *t*, *t*, is a thin board, or plate of tin or thin iron, faſtened with hinges, that it may be opened to put the ſeed into the three partitions *p q*, *q r*, *r s*. In the middle of each of theſe partitions, the barrel is pierced with holes three or four inches aſunder, and about a quarter of an inch in diameter. The barrel and the wheels are ſo fixed on the iron axle-tree, that they all turn together.

To know whether the holes *u*, *u*, *u*, in the three partitions of the barrel are of a proper ſize and number to diſtribute the ſeed in the manner that is deſired, let ſome, ſuppoſe half a buſhel, be

put

put into each partition. The blocks *n*, *n*, being placed on each ſide, between the two ſtandards, whoſe inner ſides are rounded ſo as to fit the groove in the blocks and the table *S S*, being raiſed ſo that the wheels do not touch the ground, any one may eaſily ſee, by giving the wheels a turn or two round with the hand, whether the proper quantity of ſeed drops behind the ſhare; and alter it accordingly.

The barrel being properly fitted, the beam is faſtened to the fore-carriage of this drill. As it moves, the barrel turns with the hind wheels, and the ſeed drops out of the holes *u u u*, *Fig.* 8. into the cavities *a*, *a*, *a*, *Fig.* 7, and from thence into the hollow *c*, *Fig.* 6. in the hind part of the ſhare.

When the plowman comes to the end of the field, he lifts up the hind carriage, which is light, and carries it till the horſes are turned for the next furrow.

M. Duhamel does not fix the diameter of the hind wheels, but leaves that to be determined by the length of the ſhares. His were ſo proportioned, that when the ſhares touched the ground, the wheels did not touch it by two inches. He obſerves, that this drill anſwered extremely well, where the ground was plowed into an even or level ſurface: but that the wheels were too ſmall when the middle of the ridges was raiſed high; becauſe the ſhares were then on the higher part of the ridge, while the wheels were in the furrows.

In *Fig.* 7, are two thin boards *x*, *x*, ſomewhat bending, which riſe up to about half the height of the barrel. The uſe of theſe is to catch the ſeeds that may chance to drop from the oblique holes, and guide them into the cavities *a*, *a*, *a*.

It is well known, that when the fore part of the ſhare terminates in a point, it pierces the deeper

into

into the earth, the farther back the beam is placed on the fore carriage: but as the bottom of these ſhares is round, they pierce neither more nor leſs when the beam is placed more forward. It is therefore adviſeable to place the fore and hind carriage as near as poſſible to each other, becauſe the plough then goes eaſier, and the draught is lighter to the cattle.

This inſtrument is eaſily tranſported from place to place by means of two poles *y*, *z*, *z*, *Fig*, 7. The ends *y* are placed on the fore carriage, together with the beam, and from thence paſs under the table, ſo as to raiſe the whole from the ground, on which their other ends *z*, *z*, reſt. The croſs bar *k*, *k*, ſecures thoſe ends, and keeps them at a proper diſtance.

M. Duhamel took the firſt hint of his ſeed box from an invention of Mr. Grenville, a gentleman belonging to the king of France's ſtables. This was a hollow ball, fixed upon the axle tree of two wheels, and pierced round the middle with a row of holes, through which the ſeed dropt as the wheels turned round. —— Upon a ſimilar principle, another gentleman, inſtead of ſowing under furrow in the common way, contrived a box to turn behind his plough; and that no more than the due quantity of ſeed ſhould be dropped, the lower half of the box moved upon a belt of leather, in the middle of which was fixed a piece of braſs pierced with a hole ſuited to the ſize of the ſeed intended to be ſown. By this means, the holes in the box could not drop any ſeed, but when they came oppoſite to the hole in the belt. A few grains were indeed ſometimes bruiſed in their paſſage; but, upon the whole, there was a great ſaving of ſeed.

According to the above conſtruction of M. Duhamel's drill, the ſhares muſt always pierce to the

ſame depth, becauſe the whole weight of the hind part of the drill reſts continually upon them: conſequently, it would be neceſſary to have ſhares of as many different lengths, as there are depths at which each kind of ſeed ſhould be ſown.

I likewiſe apprehend, that when the ſhares have pierced to the depth intended, the weight of the drill may be made to reſt on the wheels, by preventing the axle tree from riſing between the ſtandards, beyond ſuch a height as ſhall exactly regulate the depth to which the ſhares are to pierce. This may be effected, by bringing the ſtandards *b*, *b*, *Fig.* 7, nearer to each other; and placing between them, inſtead of the blocks *n*, *n*, *Fig.* 8, two thick pieces of wood, made to ſlide up and down, with grooves, as in the blocks. Theſe pieces of wood may be fixed between the ſtandards, by means of two ſtrong iron pins run through the ſtandards into them: and to take off the friction of the axle-tree againſt theſe pieces of wood, it may be made to turn on two friction wheels, placed in the lower patt of them; or rather on four or ſix ſmall iron rollers turning on their axis in a box inſerted in each of theſe pieces, which may be raiſed or lowered, by means of a row of holes in the ſtandards, through which the iron pins are put, ſo as to give the axle-tree room to riſe to the height that ſhall be thought neceſſary to make the ſhares pierce to the intended depth, before the weight of the drill ſhall reſt upon the axle tree.

That the axle tree, moving on ſuch rollers, will have leſs friction, or require leſs ſtrength to make the wheels turn round, even when the weight of the whole inſtrument lies upon it, than it has in the blocks, with only the weight of the grain, is evident from the following fact. The gentleman who firſt thought of this invention, applied it to a roller of four tuns weight, which is now drawn with

Fig. 1.

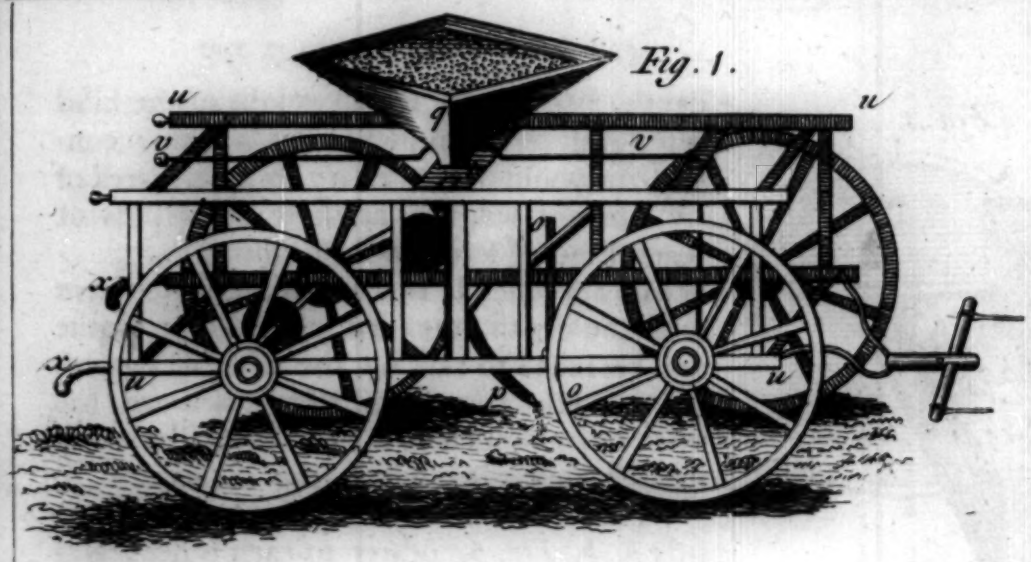


Fig. 4.

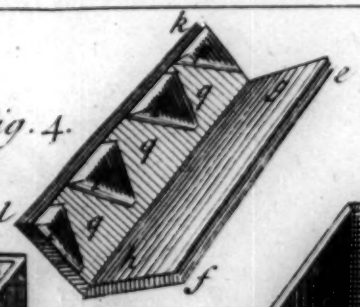


Fig. 3.

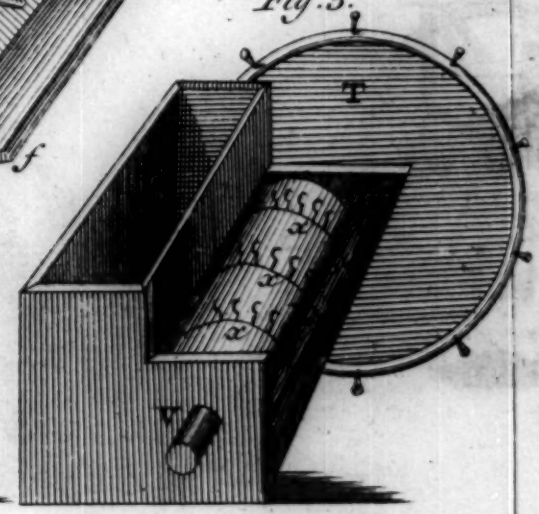


Fig. 2.

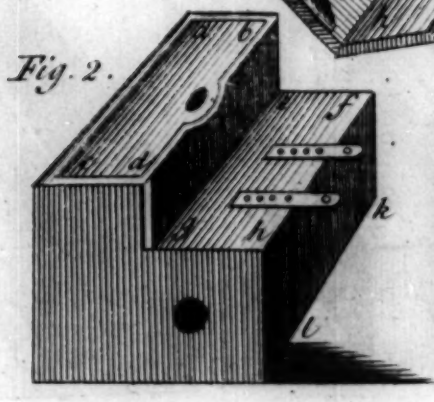


Fig. 5.

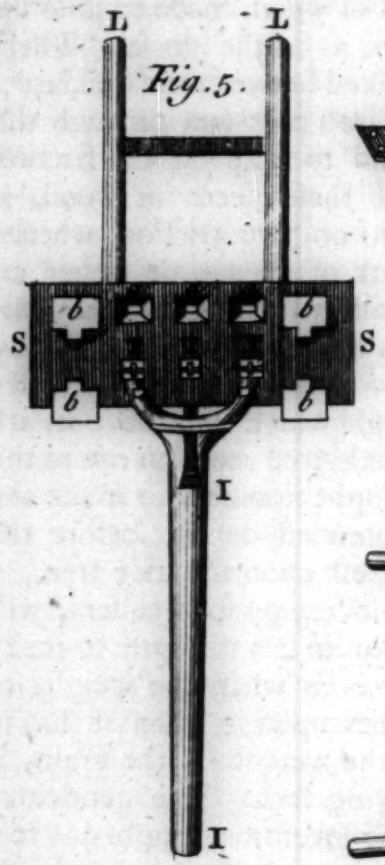


Fig. 6.



Fig. 8.

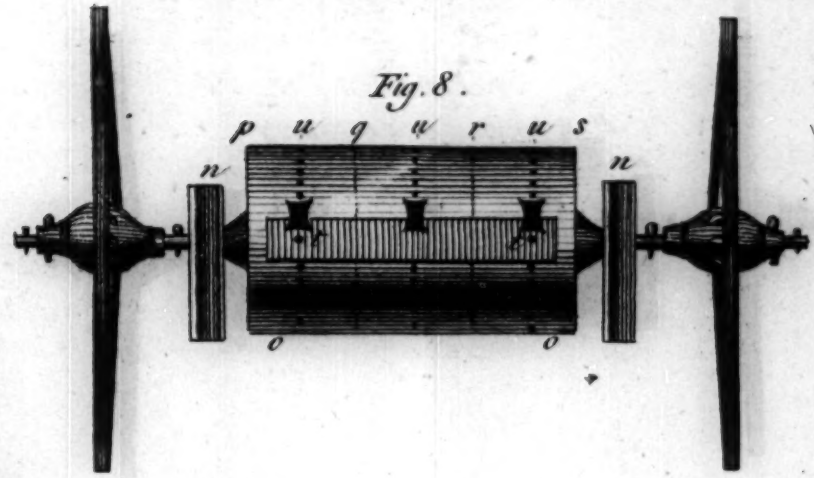
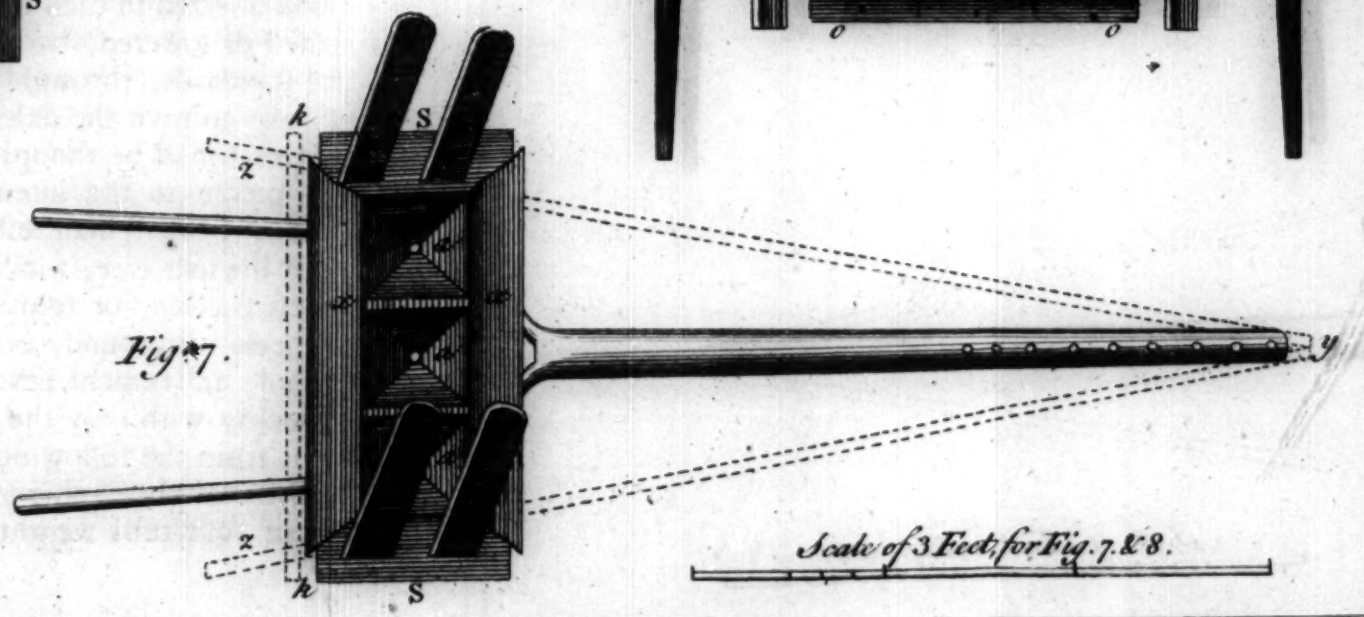


Fig. 7.



Scale of 3 Feet, for Fig. 7. & 8.

J. Goldar sc.

with eaſe by two ordinary horſes, even acroſs his plowed grounds.

It appears from this eaſy motion of the roller, that there can be no danger of the axle tree's turning; though loaded with the weight of the whole inſtrument. Other conſiderable advantages will alſo ariſe from the drill's reſting thus upon the wheels: for the labour of the plowman will be greatly leſſened, the inſtrument will move ſteadier and more uniformly, and the draught will be much eaſier for the horſes.

M. Duhamel does not ſeem here to have provided ſufficiently for covering the ſeed, which, I think, may eaſily be done, by fixing to the lower ſide of the table, a little behind each ſhare, two thin plates of iron, or two pieces of board, in an angular form, but not quite joined together, thus \/. They ſhould reach, as nearly as poſſible, ſo low down as to be level with the ſurface of the ground when the ſhares have pierced to the intended depth. Their fore part ſhould extend beyond the width of earth that is turned up by the ſhares, which they will collect into the furrow; and being open behind, if they happen at any time to gather more earth than was turned off by the ſhares, it will paſs through that opening, without clogging the drill.

To enrich this work with as many inſtruments of this kind as are conſtructed upon different and uſeful principles, and have had the ſanction of ſucceſsful experience, by which means ſome hints for ſtill farther improvements may poſſibly be ſuggeſted to ingenious and intelligent artiſts, I ſhall here add M. Duhamel's deſcription of another drill-plough of his inventing, as given in the ſixth, and laſt, Volume of his Treatiſe on the Culture of Land[a], publiſhed in 1761.

[a] *p.* 357.

"The fore-carriage of this inſtrument, *Plate* VIII, *Fig.* 1 and 2, which is ſomewhat wider than that of a common wheeled plough, has two wheels, *A A*, 24 inches in diameter; and round the thickeſt inſide part of each nave is firmly fixed a pully *B B*, the diameter of which is between 7 and 8 inches, reckoning from the bottom of the groove, which is an inch wide.

"The two wheels *A A*, and their pullies *B B*, receive the ends of an iron axle tree *C C*, which is 25 or 30 inches long, according to the width that is given to the fore-carriage. Theſe ends of the axle tree are round; but all its middle part is ſquare, and runs through a ſquare piece of wood *D*, which bears the ſaddle *E*. This ſaddle is 12 or 13 inches high from the center of the axle tree.

"To this ſquare piece of wood *D*, is faſtened the pole *F*, and on the hind part another piece through which the beam paſſes in order to reſt upon the ſaddle at *G*. Thus, excepting a ſomewhat wider diſtance between the wheels, and the addition of a pully to each nave, the fore-carriage of this drill is exactly like that of a common wheeled plough.

"The hind carriage is formed by a plank *I K*, 19 inches long, ten inches wide, and an inch and a half thick. This plank is hollowed to receive three hoppers *L L L*, *Fig.* 2. To its two ends are fixed the poles *M M*, which are 30 or 32 inches long, an inch and a half wide, and of the ſame thickneſs as the plank. In the middle is firmly fixed the beam *N*, which reſts upon the ſaddle *E*. This beam is about three feet and a half long, and only two inches in diameter.

"Upon the fore end of the poles *MM* are fixed two ſtandards *O O*, which are about ſix inches high, four inches wide, and an inch and a half thick,

thick. Their uſe is to ſupport the axis which bears the ſpindled reels, and the ſmall pullies *T T*, which are four inches in diameter from the bottom of the groove. The reels are five inches and a half in diameter, from the middle of one ſpindle to the middle of that which is oppoſite.

"The axis of the reels, which is of wood, but would be better if made of iron, is about 19 inches long, and reſts at each end in a notch in the back ſide of the ſtandards *O O*, where it is ſecured by a peg which hinders it from ſlipping out.

"Upon the plank *I K*, is placed the ſeed box *P P*, *Fig.* 1. This box is 19 inches long, 14 inches high, and 8 inches wide.

"To the two ends of this box are firmly fixed the two ſquared liſtels *Q Q*.

"The lower ends of the vertical part of theſe ſquares are faſtened to the ſhafts *M M*, by two iron pins *R R*, upon which the box moves, as upon two hinges, when there is occaſion to lean it backward, in order to prevent its dropping the ſeed, as will be explained hereafter.

"The horizontal part of the ſame ſquare *Q* ſupports an axis of wood or iron, to which the pallets are fixed; and above that a rope compoſed of ſeveral cords twiſted together, and traverſed by little bits of wood, to which this rope gives the power of acting like ſprings, which, by preſſing upon one end of the pallets, force their other end up to the holes in the bottom of the ſeed box.

"As the pallets do not paſs through the twiſted rope which acts in the nature of a ſpring, and as they are all three upon the ſame axis, it is plain that one ſpindled reel is ſufficient to make the three pallets play.

"It is proper to obſerve that each of the hoppers *L L L*, *Fig.* 2, is edged with a little ſquare frame *a a*, *Fig.* 3, about 5 inches high, upon

which the bottom of the ſeed box reſts, as upon a funnel, beyond the limits of which no ſeed can paſs, and which neceſſarily keeps every grain within the ſlope of the hopper through which it drops, if that ſlope be ſufficiently great on each ſide. There is only in the fore part of theſe funnels a notch *b*, through which the pallets paſs, that their play may be free. The pallets *b b b*, *c c c*, *Fig.* 2, with the tails *c c*, *d d*, which are behind the axis they are faſtened to, and which hitch in the ſpindles, are about 10 or 11 inches long.

"*V V* are the handles of the hind-carriage: they are 30 inches long, and about 19 inches aſunder. By holding them up a little, or by leaning upon them, the ſhares are made to pierce more or leſs deep into the ground.

"The ſhares *X X*, *Fig.* 1, are from 12 to 13 inches high, excluſive of the tenons which faſten them to the plank: they are from 4 inches and a half to 5 inches wide, and 2 or 2 and a half inches thick.

"Now it is eaſy to conceive that when this inſtrument is drawn, the wheels *A* of the fore-carriage turn, and with them the pullies *B*: theſe, by means of cords which go round them on each ſide, turn the ſmaller pullies *T* of the hind-carriage: theſe again, being fixed in the ſame axis as the ſpindled reels, *e e*, turn thoſe reels; and the twiſted rope raiſing the tails *d d*, *f f*, *Fig.* 4, of the pallets *c c*, *b b*, the holes at the bottom of the ſeed box are opened, ſo that the ſeed drops, and falls through the hoppers into the channel which carries it to the hind part of the ſhares: afterward, the twiſted rope which regulates the pallets, replaces them in their former poſition, and the holes are again ſtopped.

"*Fig.*

"*Fig.* 4, ſhews, 1, the play of the pallets expreſſed by the pricked lines from *c b*, to *c q*; 2, that of the tails, from *f d*, to *f b*; 3, that of the bits of wood which anſwer to the ſpring of the cords *i k*, from *l d* to *l m*. The pricked portions of a circle indicate the movement of theſe different pieces.

"The ſtaff *Y Fig.* 1, riſes from the great mortiſe *Z* in the beam, where it is held by a peg, and reſts upon the fore-ſide of the ſeed box *PP*, which it keeps tight down to the hoppers, and hinders from ſhaking, by the ſmall iron hook *y*. When this ſtaff is lifted, and the ſeed box is inclined, backward in the manner indicated by the pricked lines in *Fig.* 1, in which ſituation it is kept by the other end of the ſame hook *y*, when the ſtaff *Y* is let down again, no more ſeed is dropped; for the tail of the pallets being then raiſed up, they ceaſe to hitch in the ſpindles, which continue to turn with the wheels without un-ſtopping the holes in the bottom of the ſeed box. This is to be obſerved whenever the drill is to be turned at the end of a furrow; after which, by letting down the ſeed box and ſecuring it again with the ſtaff *Y*, it diſtributes the ſeed as before.

"That the cords which go round the pullies *BB* of the fore-carriage and the pullies *O O* of the hind-carriage, may not be too much or too little ſtretched (for all ropes, or thongs of leather, ſwell, and conſequently ſhorten when the air is damp, and on the contrary lengthen when it is dry,) in the former of which caſes the pullies would not turn, and in the latter the axis of the ſpindles would undergo too great friction; to obviate, I ſay, the inconveniences which would ariſe from thence, the iron pin which goes through the beam, juſt above it's neck *G*, and which, as in the common wheeled ploughs, is intended to make the hind-

carriage follow the motion of the fore-carriage, need only be taken out. The hind-carriage is then no longer drawn by the beam, which, in this drill, ſerves only to keep the plank of the hind-carriage in a nearly horizontal ſituation, and in ſome meaſure to faſten the hind-carriage to the fore-carriage. For this reaſon it is proper that the hole through which the neck of the beam paſſes, be pretty tight about it; but the hind-carriage being drawn only by the cords which go round the pullies, the reſiſtance occaſioned by the ſhares keeps theſe cords in a proper tenſion, ſo that their ſhrinking or ſtretching cannot be productive of any inconvenience, unleſs pointed ſhares be uſed, which might cut too deep, or not deep enough: but there is alſo for this an eaſy remedy, which I ſhall ſoon point out.

"By faſtening the pallets to a wooden or iron axis *n p*, *Fig.* 4, and transferring to them the ſpring of the twiſted rope by means of the little ſticks *d q*, which ſerve to twiſt the ropes and to ſecure that twiſting, the three pallets are made to play at the ſame time, and one or two ſpindled reels upon the axis *e e*, *Fig.* 1 and 2, will be ſufficient. The machine is thereby rendered ſtill more ſimple: but when two ſpindled wheels are uſed, it will be neceſſary to take care that the ſpindles of each of them act at the ſame time upon the two pallets; becauſe, if they acted at different inſtants, a jerking would enſue, which would hinder the exactneſs of the operation.

"If this inſtrument is uſed to ſow the whole of the land in equally diſtant rows, and it be ſo made that the diſtance between the rim of one wheel and the rim of the other is 28 inches, one wheel muſt be placed in the furrow made by the outmoſt ſhare, when the drill returns. But as this

wheel,

wheel, going in a furrow which has juſt been ſown, may carry away ſome of the ſeed, eſpecially if the ground be moiſt, the beſt way is to allow but 21 inches, inſtead of 28, for the diſtance from the inſide of one rim to the inſide of the other, and to bring the pullies *BB* and *TT* proportionably nearer together, ſo that there be but 13 or 14 inches ſpace between the pullies *BB*, and the pullies *TT*. This is eaſily done when there are but two ſpindled reels *e e* upon the axis.

The diſtance between the wheels being thus reduced, in order to ſow the ground all over in equally diſtant rows, inſtead of putting one wheel in the furrow cut by the outmoſt ſhare, it is placed in the track before made by one of the wheels; from whence no ſort of inconvenience can ariſe; and by this means all the furrows are regularly 7 inches aſunder.

"The ſhares may be either of wood, like *Fig.* 5, *Plate* V, or of iron, like *Fig.* 5, *Plate* VIII, where the hinder part *A*, conſiſting of two thin plates of iron, conveys the ſeed into the furrow, and the part *B* is ſomewhat ſharpened on it's foreſide, from the point upward, but is flat all along it's bottom *C*. A ſhare of this kind may do beſt in ſtiff ſoils.

"If the wooden ſhares be uſed, as they are circular at the bottom, it will be needleſs to uſe any wedges or other means to heighten or lower the beam, becauſe theſe ſhares do not penetrate more or leſs, whether the beam be high or not. But when pointed ſhares are uſed, it will be neceſſary to fix the elevation of the beam, which may eaſily be done by a wedge which heightens or lowers the upper part of the ſaddle.

"That theſe ſhares may be the leſs apt to be choaked with ſtones or clods, it is right not to place them on the ſame line when three are uſed,

but to ſet the two ſide ſhares ſomewhat forwarder than that in the middle; or perhaps ſtill better to place the middle ſhare a little more forward than the other two: but the difference muſt not be great; and if they are to be uſed in a light ſandy ſoil, they will do beſt when ſet in the ſame line.

"Some drills are ſo made that the ſhares can be brought to within 6 inches diſtance of each other, or be ſet 8 inches aſunder. To this end, the tenon which faſtens the ſhares under the plank, is let into a mortiſe 2 inches or 2 inches and a half wide; the ſhares are fixed at the intended reciprocal diſtances, by a wedge; and the pipe, or channel, which receives the ſeed when it drops from the hopper and conveys it to the hinder part of the ſhares, is extended accordingly at it's top. Theſe are minute circumſtances on which I do not dwell, becauſe every one may eaſily vary and ſuit them to his fancy. A more important article is the means of making the drill ſow more or leſs ſeed, and ſeeds of different ſizes, as the huſbandman may judge moſt proper.

"To accompliſh theſe ends, I make the hole *a*, *Plate* VIII, *Fig.* 6, in the bottom of each of the diviſions of the ſeed box, wider than it need be, even for the large ſorts of grain; but at the bottom of this ſeed box, and cloſe to each hole, I place a thin round plate of copper *b b b b*, which turns upon the rivet *c*, which faſtens it to the ſeed box. Around theſe moveable plates are holes of of different diameters *d d* &c; by means of which a greater or leſs quantity of ſeed, and either larger or ſmaller ſized ſeeds are ſowed according to the dimenſions of that hole in this plate which is placed immediately under the hole in the bottom of the ſeed box. The ſame thing may be done with either a ſquare or a long plate made to ſlip in a groove at the bottom of the ſeed box. Another

ther eaſy way to regulate the greater or leſs quantity of ſeed ſown, is by making the ends of the pallets reſt more or leſs upon the ſpindles, and conſequently enter more or leſs far into the notch *b*, in the ſide of the hopper, *Fig.*7. The more their ends reſt upon the ſpindles, the higher they will be lifted up, and conſequently the greater quantity of ſeed will fall; and ſo on the contrary. The ſame effect will alſo be produced by raiſing up a little the fore part of the ſeed box.

"If the horſe uſed for this work takes long ſteps, either the diameter of the pullies *BB*, *Fig.*1, ſhould be enlarged, or that of the pullies *TT* of the hind-carriage be leſſened; or the reels may have the fewer ſpindles, in order that the pallets may have time to fall at one end, and riſe at the other ſo as to ſtop the holes at the bottom of the ſeed box, before another ſpindle catches them up again; for otherwiſe, if the pallets were to remain conſtantly lifted up, the ſeed would drop inceſſantly: but with a ſlow paced horſe there will be no danger of this inconvenience. As the turning of the reels may be accelerated by the diameter of the pullies, I do not adviſe putting more than 4 or 5 ſpindles to the reel, that there may be the leſs hazard of the pallets being uplifted whenever the drill ſtops.

"In light ſoils, and when the ſowing is performed in pretty dry weather, the earth which falls in of it's own accord behind the ſhares, immediately covers the ſeed: but if it chances not to be ſufficiently covered by that means, a kind of rake with ſix large teeth may eaſily be made to follow the ſhares, in ſuch manner that each ſhare may be oppoſite to the ſpace between two of the teeth. This will bury the ſeed ſufficiently; or the whole field may be harrowed in the common way.

"The

"The drill which I have now deſcribed is ſimple, cheap, and eaſily made: it is uſed without trouble; is not ſubject to warp; and may eaſily be mended, in caſe of any accident, even by ordinary workmen. It may be guided very ſtrait, with as much eaſe as a common plough.

"Whoever is at all verſed in theſe matters will readily conceive the poſſibility of fitting one of theſe ſeed boxes to the ſaddle of a common plough. Inſtead of reels, the pallets may be made to play by a wheel whoſe circumference is waved, or fluted, and the ſeed will drop into the furrow."

SECT. III.

Of the Change of Crops.

EXperience ſoon taught men, that even the moſt fruitful ſoil cannot conſtantly yield the ſame grain; and this, of courſe, laid them under a neceſſity of ſeeking for means to remedy the defect. They found the plough the moſt ready, and perhaps the moſt effectual. Hence it is that all the ancient writers are full of juſt commendations of thorough plowing. At the ſame time, the ſeeming loſs of the produce of the ground during the year of fallow put them upon inquiring how this inconvenience might be prevented, conſiſtently with keeping the land in good heart. Repeated obſervations ſhewed to the Romans, the moſt attentive of all nations in every thing relative to huſbandry, that, beſides the alternate reſting of the land, wheat may, as Pliny obſerves, be ſowed after lupines, vetches, beans, or any other plant which has the quality of fertilizing and enriching the

Fig. 1.

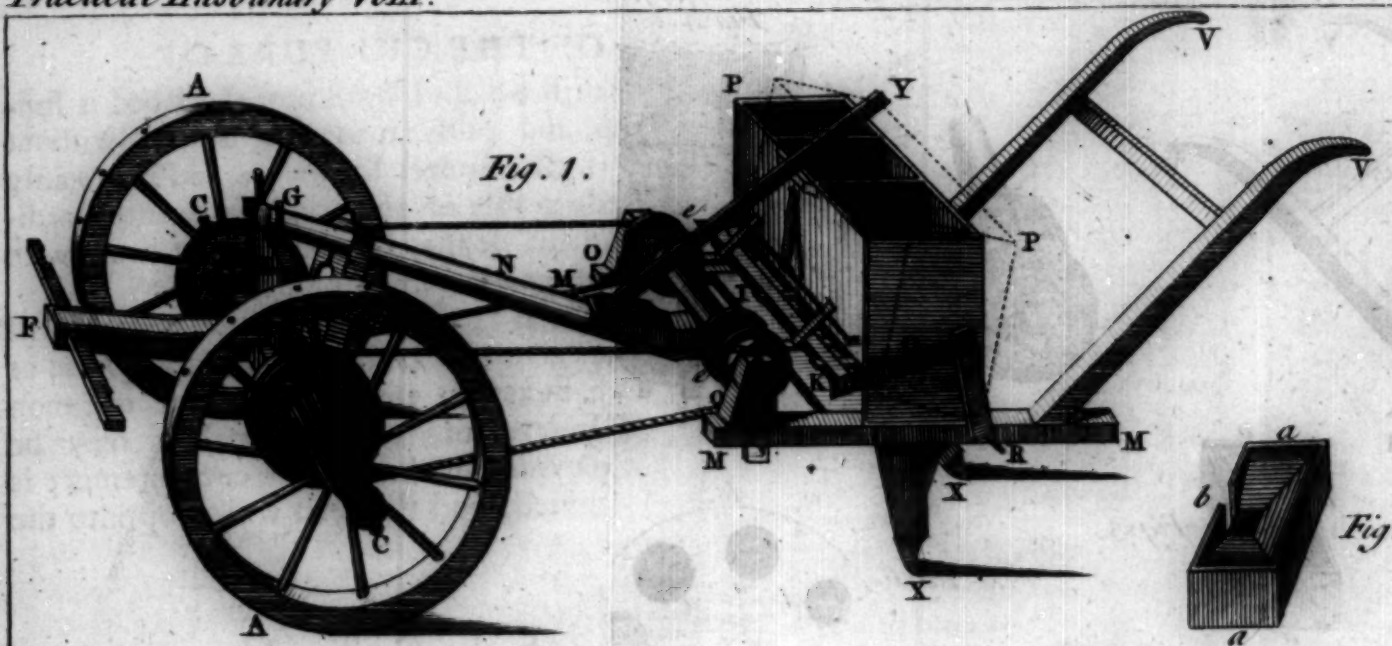


Fig. 4.

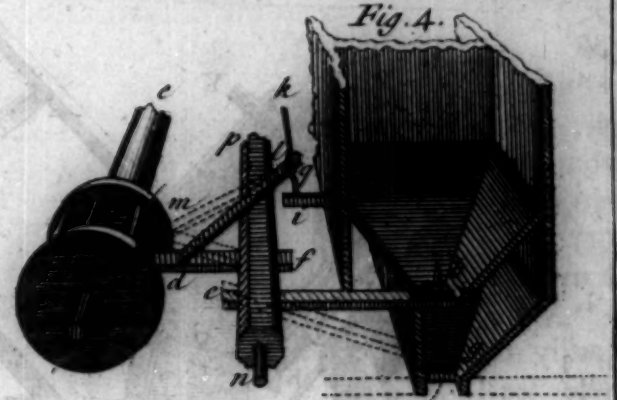


Fig. 3.

Fig. 6.

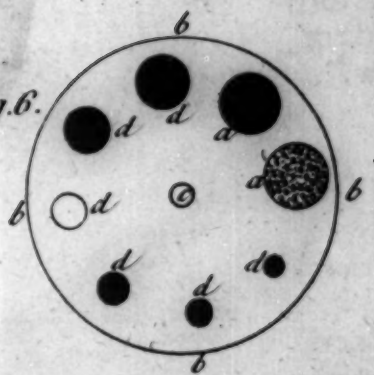
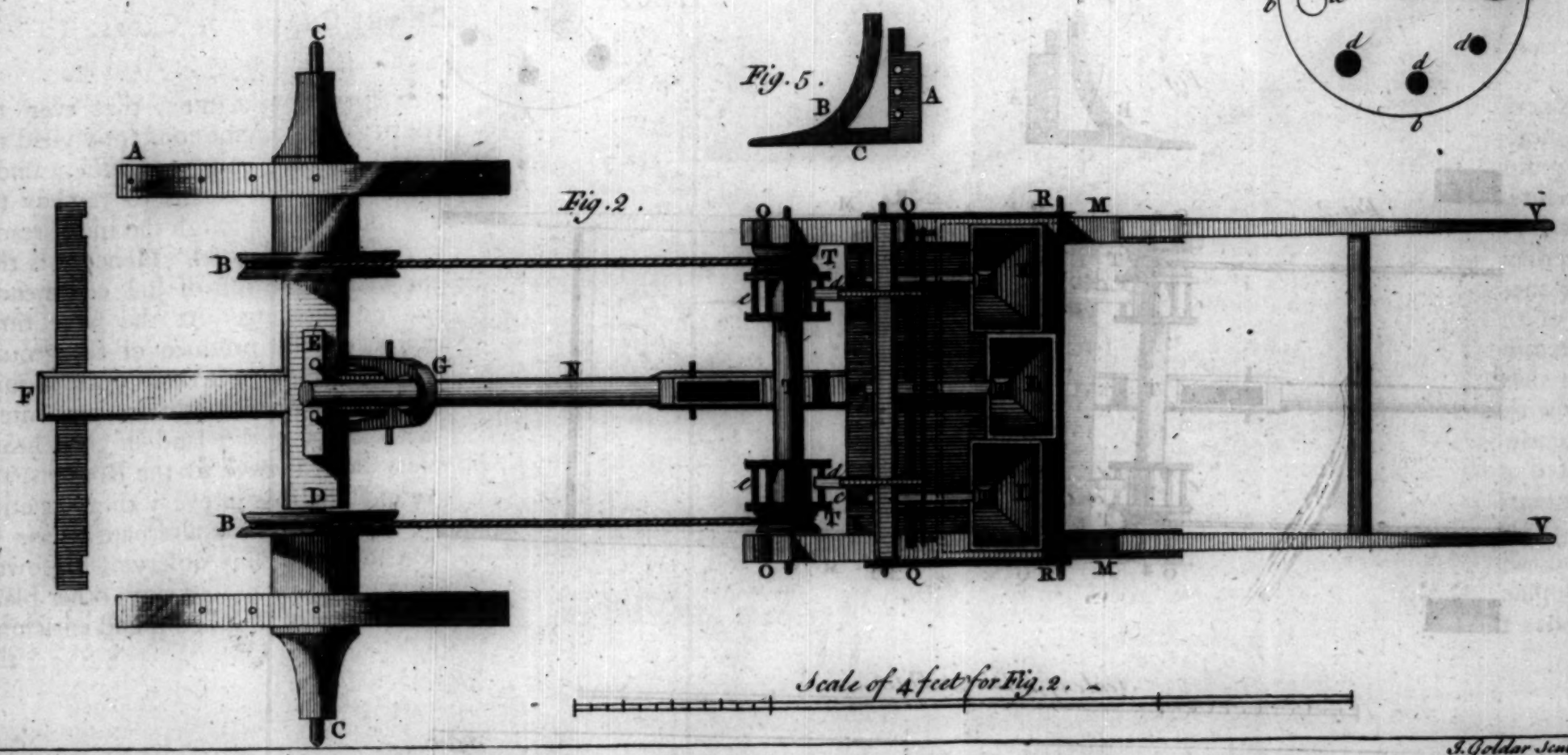


Fig. 5.

Fig. 2.



Scale of 4 feet for Fig. 2.

the ſoil [a]. This, ſays Mr. Liſle [b], deſerves to be well noticed; becauſe our farmers imagine they cannot make their rent, if they pay twelve ſhillings an acre, without ſowing their land every year, and will not lay it down to graſs.

The moſt rational change of crops hitherto pointed out by any writer ſince the time of the Romans, is that which Camillo Tarello, grieved to ſee the great and repeated errors of huſbandmen in the noble and laudable occupation of agriculture [c], which the wiſe Socrates juſtly calls the mother and nurſe of all the arts, and animated with a deſire of being ſerviceable to his country, planned by order of the Senate of Venice, and preſented to that auguſt aſſembly in the year 1566, to the following effect [d].

"Let the plowing hitherto given to corn land "divided into two portions, each of which, being "reſted every alternate year, receives four plow-"ings in that year, be transferred to the half of "one of thoſe portions, ſo that it be plowed eight "times, including the ſeed plowing. I mean, "that every farm in tillage be divided into four "equal parts, and that only one of thoſe four "parts, taking them alternately, be ſowed with "corn in any one year, after it has been plowed "eight times. Two other parts ſhould be laid "down to graſs: and the fourth ſhould be fal-"lowed a year, during which it ſhould receive "the before-mentioned number of plowings.

"He, therefore, who now has, for example, 10 "acres under corn, ſhould for the future ſow "but 5, and ſo in proportion for a larger or leſs

a *Quæ terram faciant lætiorem. Plin. Lib.* XVIII.
b *Obſervations in Huſbandry, Vol* I. *p.* 164.
c *Memoires de la Societé de Berne, Tom.* II. *Par.* 3. *p.* 681.
d *Ibid. p.* 675.

"extent;

" extent; and all the manure and labour beſtow-
" ed upon his ten acres, ſhould be appropriated
" to the five only; that is to ſay, he ſhould plow
" them eight times, unleſs the ſoil be extremely
" light."

" The huſbandman ſhould begin to plow in
" October or November, about ten months be-
" fore he ſows, or ſooner if he can; but always
" in dry weather. He ſhould lay on his dung be-
" fore the laſt plowing, and ſhould not ſow more
" than two thirds of the quantity of ſeed hitherto
" commonly uſed, and that ſeed ſhould be of the
" growth of the country."

" Whoever follows this method, may always
" depend upon the following advantages."

" 1. This way of cultuvating land leſſens the
" expence and labour, it being eaſier to plow one
" acre eight times, than to plow two acres four
" times each; becauſe, after the third time, an
" acre and a half, at leaſt, may be plowed as ſoon
" as an acre could have been before; and if the
" huſbandman begins his work in October or
" November, while the land is in good condi-
" tion for plowing, he may continue it the follow-
" ing year, at ſuch time as he will have little other
" more urgent buſineſs, ſo as to have four plow-
" ings done by the end of May, or thereabout.
" By this means, the four ſummer plowings will
" not require ſuch ſtrong ploughs as ſome people
" uſe, to the great hurt of their cattle and fatigue
" of the plowman; becauſe the ground will be
" already well looſened."

" 2. Theſe repeated plowings will deſtroy the
" ſeeds and roots of weeds, which rob the corn of
" it's food, choak it, and hinder it from grow-
" ing."

" 3. A field reſted, and then prepared in this
" manner, will yield more than double the pro-
" duce

" duce of two equal ſpaces of land cultivated in
" the common way, as I have often experienced.
" This is more than doubling one's income."

" 4. Over and above this great advantage, we
" likewiſe ſave two thirds of the quantity of ſeed
" hitherto commonly uſed: for, by ſowing, not
" the half, but only a quarter part of the land in
" tillage, there is an immediate ſaving of half the
" ſeed formerly required; and by ſowing only
" two thirds of the uſual quantity upon that
" quarter, we again gain two twelfths, that is to
" ſay one ſixth, of all the former ſeed: now half
" and one ſixth make together two thirds, to be
" deducted from the former uſual quantity."

" 5. We ſhall have a ſufficiency of ſtraw of
" every kind for all our uſes, eſpecially for litter
" and dung, ſo uſeful and indiſpenſable."

" 7. We ſhall have hay and fodder enough to keep
" many cattle; becauſe we may and ſhould ſow
" one half of our ground with graſſes, which will
" thrive extremely well, while the land is thus
" reſted for two years, in order to be afterwards
" broken up, plowed, and ſowed with corn, in
" its turn: for I again adviſe ſowing only a quar-
" ter part of the whole farm with corn, and
" breaking up another quarter immediately after
" ſeed time, before winter: and on the contrary,
" neither of the two other quarters ſhould be
" plowed during two years. But as the earth is
" deſtined continually to yield productions of
" one kind or other, even while it reſts, we
" ſhall do right in following the path pointed out
" by nature, by helping it to produce clover,
" and other plants fit for fodder, which are of
" ſingular ſervice to us, not only on account of
" the hay we reap from them, but alſo becauſe
" their roots greatly improve the ſoil. In the
" country about Breſcia, plentiful crops of the

" fineſt

" fineſt flax are reaped from fields where a quan-
" tity of clover has been lately mowed, and lands
" are let there for a great price, not only becauſe
" the ſoil is rich and can be watered, but likewiſe
" becauſe it has juſt been under clover. If ſuch
" value is ſet upon ground intended only for flax
" or millet, how much more would good wheat
" land juſtly deſerve?"

" 7. A ſeventh advantage will be, that land
" reſted regularly two years, (I ſay with Virgil
" that it reſts when it is not plowed,) being well
" conditioned, afterwards well prepared, plowed,
" enriched by the roots of the graſſes, and kept
" clear of weeds, will yield crops more than twice
" as great as any we now reap; a truth which I
" have practically experienced, which the moſt
" ſenſible and moſt judicious huſbandmen that
" ever lived have long told us, and of which
" a trial will ſoon convince even the moſt incre-
" dulous."

" 8. One of the moſt conſiderable advantages
" attending this method, is the eaſe with which a
" great number of cattle may be reared, by means
" of the increaſed quantity of hay and green fod-
" der. We ſhall conſequently have more horſes,
" more oxen, more cows, more ſheep, and more
" poultry. Every one knows of what infinite
" ſervice all theſe are, to feed us, to cloath us,
" and help us in our work. He, therefore, who
" has hitherto been obliged to have two yoke of
" oxen, will, in this method, want only one, and
" may, in lieu of the other, feed two or three
" cows: for as the labour is hereby leſſened, and
" the quantity of good fodder increaſed, two oxen
" will be ſufficient to plow the land, eſpecially as
" the ſoil will, by theſe means, be brought daily
" into better and better tilth."

" 9. From

" 9. From hence naturally follows a ninth ad-
" vantage, which is, the quantity of manure pro-
" duced by the increaſe of cattle and of ſtraw;
" an advantage which no good huſbandman will
" neglect to purchaſe, if the means of doing it are
" but pointed out to him."

" The 10th, and laſt of the advantages which
" I ſhall here enumerate as reſulting from this new
" method of culture, is that poor and barren
" lands are hereby rendered, by degrees, good
" and fertile: for ſuch is the conſtitution of the
" earth, that plowing and manuring alter it's very
" nature, and improve it more and more, as ex-
" perience repeatedly demonſtrates. Valerius
" Maximus inſtances the ſtriking example of Ma-
" ſiniſſa, king of Numidia, who made agriculture
" flouriſh ſo much that he left his country, which
" he had found barren and deſolate, ſtored with
" riches and every good thing. It is in our power
" to do the ſame. On the contrary, it is not leſs
" true, that even though the earth be rich and
" good, it will yield but little fruit, if it be not
" well cultivated; reſembling therein the capacity
" of the human mind, which, according to Ci-
" cero's fine compariſon[e], is enlarged only by
" ſtudy and exerciſe. Induſtrious labour will not
" only procure us the neceſſaries, nay the ſuper-
" fluities of life, but will even change a barren
" country into a kind of garden."

M. Duhamel, after obſerving[f] that the French farmers, in general, (and the ſame may be ſaid of thoſe of other countries,) change their crops, not upon any principle dictated by reaſon, but merely becauſe it was the cuſtom of their fore-fathers,

e *Nam ut ager quamvis fertilis, ſine cultura fructuoſus eſſe non poteſt ſic ſine doctrina animus.* M. T. Cic. Tuſc. 2.

f *Culture des Terres, Tom.* VI. *p.* 34. *and ſeqq.*

or

or they perhaps have occaſion for ſome particular growth; draws a parallel between the practice of dividing arable land into three parts, or into two, in order to their being alternately ſown, and reſted. "I have" ſays he, "ſome knowledge of "what is done in this reſpect in Guyenne, and in "different parts of Normandy; and, thanks to "the Baron de Sournia, governor of Queribus, "am enabled to give a particular account of the "the practice about Perpignan, where that gen-"tleman's eſtate is ſituated."

"In that very hot climate, the huſbandman ſows in September, and begins to cut his wheat about the 12th of June, ſo that his harveſt of that grain is generally over by Midſummer.

"The lands there are divided into only two portions, one of which is ſowed with wheat each alternate year, while the other ſhould be reſted. But ſome of the beſt pieces of ground are made to bear ſeveral crops during the year of fallow; by which means they are impoveriſhed, and the ſowing of wheat is frequently delayed ſo long, that the crop proves much leſs plentiful than it would otherwiſe be. I ſhall here relate what M. de Sournia has moſt obligingly communicated to me upon this ſubject."

"In land which can be watered, clover is immediately ſowed upon the wheat ſtubble; the ground is then watered directly, and that watering is repeated ſeveral times during the autumn. In winter, it ſerves for paſture to ſheep and lambs. Thoſe who do not keep flocks, let out their clover grounds to farmers who live upon the mountains, and who have ſheep, which they cannot feed, becauſe their lands are covered with ſnow. A crop of clover, thus let, produces a conſiderable income.

"In ſpring, when the green fodder has been eaten down, the ground is laid under water; the clover ſoon ſhoots up again; it is mowed when in bloſſom, dried, and laid up like other hay.

"Immediately after this crop, the land is dunged; and thoſe who are not afraid of wearing it out, plow it, and ſow kidney beans or the ſmall kind of millet: but as it cannot be plowed for wheat, till after theſe crops have been taken off, there is not time to prepare the ground properly; the wheat ſowing is retarded, and part of the virtue of the dung is exhauſted by thoſe leſs valuable crops, while this manure might be more uſefully employed in land which cannot be watered. M. de Sournia has found by experience, that, to have good crops of wheat, this grain ſhould be preceded only by clover, and that no more kidney-beans, millet, &c. ſhould be ſowed on land intended afterwards for wheat, than is neceſſary for the uſe of the family.

"In Guyenne, a crop of maiz, which is a great impoveriſher of the ground, is raiſed during the year of fallow."

"Thus good huſbandmen think that the beſt way, in good ſoils which cannot be watered, is, in a farm for example of 300 acres, to ſow alternately 150 acres with wheat, and to plow well the other 150 acres during their year of fallow, in order to fit them for the ſame grain the next year. This is the common practice in ſome parts of Normandy, where a colder climate, and more backward ſoil, ſcarcely permit the reaping of any other crop than wheat.

"It is plain that by dividing a farm of 300 acres of arable land into two equal parts, one of which is ſowed each alternate year, while the other is reſted, the huſbandman will reap, in nine years, the produce of 1350 acres of wheat; whereas he would reap the crops of only 900 acres, if the

ſame ground were divided into three portions, and only one of them was to be ſowed each year. But in this laſt caſe he would alſo reap 900 acres of ſpring corn, which, at the common eſtimation of half the value of wheat, would be juſt equivalent to the produce of the 1350 acres of wheat. From whence it follows, that in countries which abound in paſture, where oxen are uſed for plowing, and where no oats are conſumed, there is an advantage in dividing the land into two portions, one to be ſowed, and the other to be fallowed, in alternate years; but that this is not practicable in farms where the plowing and other work is done by horſes, becauſe the expence of buying the neceſſary quantity of oats would abſorb the produce of the additional 450 acres of wheat.

"The farmers in lower Normandy, towards Bayeux, have two methods of changing their crops.

"According to one of thoſe methods, 1. Buckwheat is ſowed towards the end of June; 2, when the ſtalks and roots of this plant are dead and withered, which is about All-Saints, the ground is plowed and immediately ſowed with wheat: conſequently this grain is ſowed upon only one furrow. It is true that the land has been plowed before, and even well manured, for the buckwheat; and that plenty of manure may compenſate for the want of thorough plowing, which, in return, may ſupply the deficiency of manure: 3, after the wheat harveſt, the ſtubble is turned in as ſoon as poſſible, and a ſecond plowing is given in February or March, in order to ſow oats; or, a plowing more is given in order to ſow barley: 4, the barley ſtubble is turned down in the winter, and after a plowing in the ſpring, peas or vetches are ſowed: 5, as ſoon as theſe pulſe are taken off, the ſoil is turned down, that it may receive

receive two plowings before the month of October, when it is ſowed with wheat: 6, the next year, it is ſowed with oats, mixed with a little clover ſeed; and afterwards this ground is laid down to paſture for three or four years. It were needleſs to obſerve that the farmer varies the order of his ſucceſſive crops, according to the nature of the ſoil and his own wants: but, by this method, ſix crops have been reaped in ſix years; *viz.* two of wheat, two of oats, one of buck-wheat, and one of peas or turnips; and the field remains ſown with clover, which affords paſture for cattle during four years.

"According to the other method, no buck-wheat is ſowed upon the land broken up: but it is left fallow from the time of breaking it up, which is in February or March, till October; during which interval it is manured, and receives ſeveral plowings, which fit it for wheat. In this caſe the crop generally is more plentiful, than when buck-wheat has been ſown. In other reſpects, the change of crops is the ſame as was mentioned before."

The changing of crops, upon rational principles, though of infinite conſequence in agriculture, ſeems to have been neglected, and even forgotten, after the times of the ancient Romans, till Camillo Tarello pointed out it's great importance: nor do we, ſince him, find much attention paid to this eſſential part of huſbandandry, till very lately, when the culture of turnips probably gave the uſeful hint; the farmer obſerving, that his land, inſtead of being impoveriſhed by that root, was enriched and prepared to yield a better crop of barley in the ſpring. This might naturally ſuggeſt to him, that other ſucculent plants which cover the earth with their leaves, might have the ſame effect. The ſucceſs has anſwered

his utmoſt expectation: for it is now found, that a fallow does not become neceſſary in ſeveral years; the ground being kept in heart by a variety of crops, when rightly timed and properly managed. The Society of Improvers in the Knowledge of Agriculture in Scotland, from whoſe tranſactions [g] I ſhall borrow the following judicious inſtructions, have the honour of firſt ſetting this diſcovery it it's proper light.

They obſerve, "that ſome crops, as peas, beans, clover, and all plants of the pulſe kind, are enrichers and cleaners of the earth; whilſt wheat, oats, barley, and the whole tribe of vegetables whoſe roots are fibrous, and ſpread far, impoveriſh and rob the ground. Theſe laſt are likewiſe foulers of it, by giving way to weeds and graſs, which, being the natural product of every ſoil, are more readily nouriſhed by it, than any plant which it does not ſpontaneouſly produce; and if the earth be fed with any ſort of manure, it will, while the weeds and graſs remain undeſtroyed, like a tender mother, cheriſh and nouriſh them in proportion to the food ſhe receives." — The ingenious Dr. Home accounts very rationally for the advantages ariſing from changes of crops, by aſcribing them to the different effects of their roots [h].

"Wheat and oats are great robbers of ſoils. Wheat remains in the ground a long time, during which the land un-tills itſelf, coaleſces, and becomes of the nature of uncultivated earth; while the weeds, meeting with no oppoſition, ripen, and ſhed their ſeed. Oats do not continue ſo long: but they bind the ſoil by their ſtrong roots, and give many weeds time to ripen. Barley, as it

[g] MAXWELL's *Collection, p.* 219. *and ſeqq.*

[h] *Principles of Vegetation, p.* 162.

ſtands

ſtands only a few months, and ſeveral plowings are given for it, binds the earth leſs than wheat or oats. Peas, beans, tares, &c. are ſuppoſed to draw much of their nouriſhment from the atmoſphere, and that in proportion to the ſucculency of their ſtems and leaves, whereby it is probable their roots diſcharge a moiſture under ground; and their leaves, covering the ſurface of the earth, return the moiſture and dews deſcending through them, which mellow and rot them into a kind of manure."

The farmer may from hence be guided how to vary his crops, ſo as to keep his ground in heart and clear of weeds. Thus, in a ſtrong loam, let us ſuppoſe that a crop of wheat ſucceeds a fallow, and that the land, being laid rough in the winter, is prepared for beans to be ſown in the ſpring. As it is eſſentially neceſſary to keep this ſoil conconſtantly ſtirred, after the beans are taken off, it is laid up rough during the winter, that it may be prepared for barley and clover ſeed in the ſpring. The ſecond crop of clover may be plowed down the next year, early enough to allow time for a ſecond plowing for wheat, which may be ſucceedby a crop of beans, peas, or any roots, as the farmer ſhall judge proper. After theſe, a crop of oats may be taken, as preparatory to fallowing, which this kind of land requires more frequently than a light ſoil. If the earth is kept ſufficiently mellow, a crop of carrots or parſnips will bring a much more profitable return than turnips, on this ſoil; becauſe it is apt to be poached if the ſheep eat them off the ground, unleſs the weather prove extremely favourable. Winter vetches, or tares, may be ſown, to be taken off before the barley is ſown. On the other hand, if the ſoil is light, turnips may be ſown as ſoon as the ground can be plowed after the wheat, which will prepare the earth for a crop of barley and clover, to be

ſucceeded by wheat on one furrow, if the ground is in good heart. Peas, potatoes, or other roots, may properly ſucceed the wheat: and thus the farmer's own genius will vary his method, according to the demands at market, or his wants at home. — As the culture of each of theſe plants will be treated of ſeparately, it would be needleſs to add any thing farther here.

SECT. IV.

Of the culture of

GRAIN AND PULSE.

according to the old Huſbandry.

ALL writers on Agriculture conſtantly direct changing the ſeeds of every kind of grain, for ſowing; but, perhaps, without ſufficiently attending to the reaſons which render that practice highly expedient.

Some plants agree better with one climate than another. Such will thrive beſt in the ſituation which may be called the moſt natural to them. Sickly plants never bring their ſeeds to perfection; and to this it is undoubtedly owing, that the ſeeds which are gathered in a climate that does not agree with the plant, produce that plant leſs perfect than thoſe which are gathered in a climate natural to it. — Another eſſential reaſon for changing the ſeed, is, that ſome weeds delight in particular ſpots, and do not grow ſo freely elſewhere: conſequently, if the farmer ſows wheat of his own growth, he increaſes the weeds which thrive particularly in his land; whereas, by ſowing ſeed from other ground, the weeds which he brings

brings into his own, not being in the ſoil that agrees beſt with them, will do the leſs damage to his corn.

Some farmers, as well as ſome writers, are of opinion, that plants not only degenerate, if the ſeed is not changed, in climates or ſoils which do not agree with them; but that they even change their ſpecies, ſo that wheat becomes barley, oats, tares, &c. They are right in regard to the former part: but the latter ſuppoſition has long been exploded, and was again lately refuted by the following experiment made by one of M. Duhamel's judicious correſpondents.

The chevalier de Laumoi[1], to ſatisfy himſelf whether ſpring wheat does really degenerate into barley, as many have aſſerted; and well knowing that it is hardly poſſible to buy wheat in which there is not ſome mixture of barley, any more than it can be had abſolutely free from rye; picked grain by grain a quantity of ſpring wheat ſufficient to ſow an acre of land, and at the ſame time ſowed another acre with un-culled ſeed, as bought at the market. He was not ſurpriſed, at harveſt, to find barley in this laſt acre; for, as he had ſowed it, it was natural he ſhould reap it: but in the other acre, where he was ſure he had not ſowed any barley, he did not find a ſingle ear of it; nor could he, on a nice examination, find one grain of barley in any of the ears. If, therefore, a little rye is found in winter wheat, and a little barley in ſpring wheat, it is, becauſe theſe grains are ſowed in the ſame ſeaſon, in lands alike prepared; and they are gathered in at the ſame time, and often laid up in the ſame barn. This is more than enough to occaſion the mixture frequently obſerved.

[1] DUHAMEL, *Culture des Terres, Tom.* I. *p.* 153.

If the farmer has not ſeed of his own free from theſe imperfections, and ſuch, in all reſpects, as was before adviſed to be choſen [k], it would be highly imprudent in him not to change his ſeed, by procuring the beſt in his power: for though it is found that poor ſeed will ſometimes produce good and thriving plants, yet the huſbandman ſhould never run a riſk where his intereſt is ſo much at ſtake.

ARTICLE I.

Of the culture of

Wheat and Rye.

IT has been very juſtly obſerved by the ancients, as well as moderns, that wheat will grow in almoſt any part of the world, and that, as it is the plant moſt neceſſary to mankind, ſo it is the moſt general, and the moſt fruitful. It thrives not only in temperate climates, but alſo in very hot, and very cold regions; and, when ſown in places where it never grew ſpontaneouſly, ſucceeds as well as where it has been always common. The ſucceſs of our crops of wheat in America plainly prove this: and in Peru and Chili in particular, where this grain was not known till the Europeans introduced it there, it now produces as large crops as in moſt parts of Europe [a].

Wheat ſhould be ſowed in autumn, and always when the ground is moiſt. In the downs of Hampſhire, Wiltſhire, and Dorſetſhire, farmers begin to ſow their wheat in Auguſt, if any rain has fallen,

[k] See *Art. I. Of the choice of Seed, p.* 289.

[a] DESLANDES, *Trait. Phys.*

and

and even employ their people to ſow one place, while they reap another, if wet weather interrupts them in their harveſt: for if the corn is not forward in autumn, ſo as to cover the ground before winter, it ſeldom does well on thoſe high dry lands, eſpecially if the enſuing ſpring prove likewiſe dry. In low ſtrong lands, ſome huſbandmen think they are in good ſeaſon, if they get their wheat into the ground by the middle of November; nay, it ſometimes is Chriſtmas, or even later, before all their wheat is ſown. But this late ſown wheat, beſides being apt to run too much to ſtraw, eſpecially if the ſpring be moiſt, is liable to be thrown out of the ground by froſts, as I have already obſerved.

In general, all wheat ſucceeds beſt upon ſtrong ſoils, eſpecially if they have been well drained, ſo that the corn lies dry: but as ſome ſorts of this grain thrive better in ſome ſoils than in others, it might redound to the public welfare if more particular obſervations were judiciouſly made, in regard to each kind, than have hitherto been. The white egg-ſhell wheat is reckoned beſt for light lands, and to ſow with rye for meſlin; becauſe it ripens ſooneſt. It ſhould alſo be the earlieſt in the ground. This ſpecies is much ſown in Eſſex, upon their hazely brick-earths, or loams; as the red-wheat, and the Poland bearded wheat alſo is there, and in Hertfordſhire upon ſtiff yellow clays. The white Poland, or pole-rivet wheat has not a hollow ſtraw, and therefore is not ſo ſubject to lodge as other corn that has. This kind is particularly fit for lands where the crop is apt to run much to ſtraw [b].

In Oxfordſhire, they have a ſort of wheat which they call long coned-wheat, and reckon the beſt

[b] MORTIMER's *Huſbandry*, *Vol.* I. *p.* 126.

for

for rank clays. It's ſtraw not being hollow, it is the leſs liable to lodge, and farmers obſerve that it is the leaſt apt to be mildewed, or be eaten by birds, from which laſt it is greatly guarded by it's long rough awns; but the flour of it is ſomewhat coarſe. Their white kind of red ear'd wheat has a white ear and a red grain, and is a very good ſort for clayey land. It yields a good crop, and ſeldom ſmuts.

In Staffordſhire, they reckon the red Lammas or bearded wheat the beſt for cold lands or ſtiff clays.

In Berkſhire is a wheat called pendulum-wheat, from the hanging of it's ear, much like the cone-wheat.

In Northamptonſhire, they have a ſort of wheat with a white ſtraw and reddiſh ear and grain; much commended for the plumpneſs and largeneſs of the grain, and the ſtrength of the ſtraw, which prevents it's being ſubject to lodge; nor is it apt to be eaten by birds. They have alſo a red eared bearded wheat, and a ſort of pollard or duck-bill wheat, as it is called, known in Suſſex by the name of fuller's wheat, which has ſo cloſe and thick a huſk, that the birds never injure it. Mr. Miller obſerves [c] that this ſort of wheat grows very tall, and, if it be ſown too thick, is very apt to be lodged by rain and wind; for that it's ears are large and heavy, and incline on one ſide as the grain increaſes in weight; but that, if it's roots are at a proper diſtance from each other, it will tiller greatly and have ſtrong ſtalks, and that the grain of this wheat yields more flour in proportion than that of any other ſort. The awns of of this wheat always drop off when the grain is full grown.

[c] *Gardener's Dict.* Art. TRITICUM.

Smyrna

Smyrna wheat, commonly called many-eared wheat, becauſe ſeveral leſſer or collateral ears grow around the bottom of the main ear, which is very large in it's ſtate of perfection, requires more nouriſhment than the common huſbandry in the large way can give it, and therefore is not cultivated by our farmers: but it would, probably, do extremely well in the horſe-hoeing huſbandry, where the quantity of food can be enlarged almoſt at pleaſure. For the ſame reaſon Maiz, commonly called Turky or Indian corn, is fitteſt for this laſt huſbandry, under which it's culture will be more particularly noticed.

Some gentlemen have been curious enough to procure their ſeed wheat from Sicily, and it has ſucceeded very well as to the growth: but the grain of this ſpecies has proved too hard for our Engliſh mills to grind.

The beſt time for ſowing wheat is about the beginning of September, eſpecially if any rain has fallen; a circumſtance ſo eſſential, that, if the earth be very dry, the farmer had better ſtay till friendly ſhowers have moiſtened his ſoil, than put his corn in ground where it will not grow before it has been wet, let the time be ever ſo long. Mr. Mortimer ſays[d] he has known wheat to be ſo muſtied and ſpoiled by laying long in the ground, before rain came, that it has never grown at all: to which he adds, that he has likewiſe ſeen very good crops of wheat from ſeed ſown in July. At all events, the huſbandman ſhould certainly have his wheat ſowing finiſhed by the middle of October. Whoever neglect this, ſhews in ſo doing, a want of proper oeconomy in his affairs, and will have cauſe to repent the delay.

[d] *Vol.* I. *p.* 127.

Early ſowings require leſs ſeed than late ones, becauſe the plants then riſe better, and acquire ſtrength to reſiſt the winter's cold. More ſeed ſhould always be allowed for poor lands than for rich, becauſe a greater number of plants will periſh on the former. Rich lands, ſowed early, require the leaſt ſeed of any.

Another circumſtance which the huſbandman ſhould carefully attend to in ſowing, is that his eſtimate of ſeed be formed, not from the capacity of any particular meaſure, but from the number of grains which that meaſure will contain; becauſe the grains of ſome growths of wheat are much larger than thoſe from off other lands, though of the ſame ſpecies, and perhaps equally good. By not conſidering this, the ground will of courſe frequently be ſown too thick, or too thin: though I believe farmers are ſeldom apt to run into this laſt extreme. That they too often commit the former error, ſo manifeſtly contrary to their intereſt in every reſpect, is demonſtrated by reaſon, and by daily experience: —— but neither of theſe is ſufficient to make them deviate from the beaten track. Inſtead of the uſual allowance of three buſhels of ſeed wheat to an acre of land, repeated trials have ſhewn that half that quantity is generally more than ſufficient: conſequently a great deal of corn is actually thrown away; for the expence of purchaſing ſeed, which moſt ſkilful huſbandmen do, at leaſt every other year, amounts to a conſiderable article in large farms, and in a whole country, merits the attention of the public, eſpecially in ſcarce years: beſides which, the future plants, crowded together by being thus ſown too thick, and not having a ſufficient ſpace allowed them for their ſuſtenance, cannot yield near ſo fine and plentiful a crop as they would otherwiſe produce. A fair trial, made

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with proper care, would ſoon convince farmers of their error in this reſpect: for if they but examine a field of corn ſown in the common way, they will find few plants with more than two or three ſtalks, unleſs by chance, where ſome of them ſtand ſo as to have room to ſpread. Theſe will have ſix, eight, or ten ſtalks, and frequently many more: but a field of wheat ſown with only a buſhel of good corn has been known to be well covered with healthy vigorous plants, each of which has had from ſix to fourteen, or more, ſtalks, crowned with long well nouriſhed ears, full of fine plump grain, of which it has yielded a much greater quantity than any of the neighbouring grounds ſown with the common allowance. If the land is good, and the plants ſtand at a proper diſtance from each other, few of them will produce leſs than the above number of ſtalks and ears. But farmers think they ſhall have no crop if the ground is not covered with the blades of corn by the ſpring: whereas, if they would have patience to wait till the plants put out all their ſtems, they would be amply convinced of the contrary. Every one muſt have obſerved in places where foot-paths are made through corn fields, that, by the ſide of thoſe paths, where the corn is thin, and has been trodden down in the winter and ſpring, the plants have ſtood erect, when moſt of the corn in the ſame field has been laid flat upon the ground; an advantage which can proceed from no other cauſe, than that their ſtalks are ſtronger from their having more room: for thoſe of the other plants are drawn up tall and ſlender by being too cloſe together.

More ſeed is commonly ſowed upon new-broke up ground, than upon that which has been longer in tillage. From half an inch to three inches is the uſual depth at which wheat is planted, according

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ing to the nature of the ſoil; the ſtiffeſt lands requiring the ſhalloweſt ſowing, as was before obſerved. The general cuſtom is, to ſow it under furrow, which is certainly moſt adviſeable if the ſoil be ſhallow, to prevent the plants being thrown out by the winter's froſts, or their roots being left bare by the drying winds in the ſpring. Some ſow in broad caſt, either with a ſingle caſt, or a double bout, harrowing once between; after which the ground is again harrowed ſeveral times, till the ſeed is well covered. However, a great deal of it will become the prey of birds, in this manner of ſowing. On the other hand, in planting the corn deep, there is the greater danger of it's being eaten off by worms between the grain and the blade.

Great care ſhould be taken to guard againſt the rooks juſt at the time when the wheat is ſhooting up. Theſe miſchievous birds perceive it's ſprouting much ſooner than the farmer can, and are led by the ſhoot to pick it up. They muſt therefore be carefully kept off the ground for a week or ten days at this ſeaſon; for at the end of that time the blade will be grown up, and the grain ſo exhauſted of it's ſubſtance, that they will not give themſelves any trouble about ſtealing it. They never moleſt the wheat which is ſown about Michaelmas; becauſe ſo much grain of the late harveſt then lies ſcattered about the fields, that they find it eaſier to pick up that, than to ſearch for corn under ground, in the new-ſown lands.

No part of huſbandry requires the farmer's attention more, than keeping his land free from weeds: yet few trouble themſelves much about this eſſential article, are ſenſible of it's importance, or underſtand the proper method of doing it: nay, many do not even know which weeds are annual, and which perennial; a diſtinction highly

neceſſary

neceſſary to be made by every perſon who would keep his ground clean and in good order, and without which the greateſt induſtry will often be baffled. Annual weeds may be ſoon deſtroyed, if taken in time: but if they are neglected, their ſeeds will ripen, and ſow themſelves in ſuch abundance, that much additional labour and expence will be required to do that which might have been performed with eaſe at the beginning, without ſubjecting the corn to be robbed of it's nouriſhment by bad neighbours. The common method of weeding is very abſurd [e]: for in that practice the weeds are left to grow till the wheat begins to ear, and they are in flower; by which means, the ground being covered by the corn, all the low weeds are hid, left to ripen, and ſcatter their ſeeds: only the tall weeds are taken out; and if the people employed are not careful, many of theſe will eſcape them, by being ſo intermixed with the ſtalks of the wheat, as not inſtantly to be diſtinguiſhed. At the ſame time great numbers of the plants of wheat are broken and trod under food by the weeders.

To obviate theſe inconveniences, Mr. Miller recommends [f] the method now practiſed by good kitchen gardeners, who clear their ground with a ſmall kind of hoe, which, if uſed among the wheat early in the ſpring, before the ground is covered by the blades of corn, will effectually eradicate all the weeds, eſpecially if this work be done in dry weather; becauſe, being ſmall, they then ſoon wither and die. If the ground happens to be very full of weeds, it may be neceſſary to go over it a ſecond time, about a fortnight after the firſt, to cut up thoſe which may have been too ſmall to be noticed. By this means the corn will

[e] MILLER's *Gardner's Dictionary*, Art. TRITICUM. [f] *Ibid.*

be

be kept clean, freed from robbers which would deprieve it of due nouriſhment, and there will not be time for new weeds to grow ſo as afterwards to do it any great prejudice: for the ground will be ſo much ſhaded by the corn, that the weeds will thereby be kept down, in ſuch manner as not to ripen their ſeeds before harveſt.

If, at the time of this operation, ſome of the plants of corn are cut up where they grow too cloſe, the reſt will be greatly benefited thereby: "but "in this, adds Mr. Miller, I fear that few of the "old farmers will ever agree with me, though what "I mention is not from theory, but from expe-"riments, repeated with great care, and ſuch ſuc-"ceſs, that the produce of twenty rods of ground "was much greater, both in weight and meaſure, "than that of the ſame extent in the very beſt "part of the field, where this was not practiſed; "and the ſtalks of the corn thus thinned ſtood "upright, when a great part of the crop in the "ſame field was lodged."

Both the advantage of having the plants of corn at proper diſtances from each other, and that of keeping them quite free from weeds, two difficult, not to ſay almoſt impracticable, taſks to be completely effected in the common method of ſowing, are fully obtained in the new huſbandry, as will ſoon be evidently ſhewn.

M. Duhamel and Mr. Miller juſtly blame the practice of thoſe who either turn hogs in among their wheat, to deſtroy part of it when it grows too thick; or ſheep to eat it down, when they think it too rank. The abſurdity of the former is ſelf evident: and in regard to the latter, it is well known, from long experience, that the leaves, or blades, of corn are neceſſary to draw in nouriſhment from the air and dews, for the increaſe of of the ſtalk and ear. To be thoroughly ſatisfied

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in this, Mr. Miller cut off the leaves of ſome plants of wheat, alternately, early in the ſpring, and always found the ſtalks of theſe plants much ſmaller, the ears ſhorter, and the grain poorer, than thoſe of the intermediate plants whoſe blades were not cut. Several experiments made by M. Duhamel have proved, not only that all plants are impeded in their growth, and rendered leſs perfect in their productions, but often even killed, by ſtripping them of their leaves: and this is confirmed by Mr. Miller, who adds, that he has frequently obſerved in gardens, that plants diveſted only of their lower leaves, plucked off by ignorant perſons upon a ſuppoſition of their drawing the nouriſhment from the head, have been greatly weakened thereby. The ſame will undoubtedly hold good with reſpect to corn; beſides which, cattle, and particularly ſheep, will often bite ſo cloſe as to deſtroy the crown of the plant, from whence it's future growth ſhould proceed.

Wheat is ripe when it's ſtraw is turned yellow, it's ears hang, no greenneſs appears in the middle of them, and the grain is hard when bitten. From four to five quarters is reckoned a good crop: but ſome would hardly credit how much beyond this the produce of good ground, thoroughly well cultivated, may be increaſed. Thoſe who are ſenſible of the vaſt advantages of a perfect culture, will not be ſurpriſed at Mr. Miller's aſſuring us[g] that he has known eight and ten quarters, and ſometimes more, reaped from an acre, over the whole field, where the corn has ſtood thin upon the ground; and that he has been informed by perſons of great credit, that even twelve quarters have been reaped from an

[g] *Ubi ſupra.*

acre of land drilled and managed with the horſe-hoe.

Mr. Miller is of opinion [1] that all the rye cultivated in England is but one ſpecies of the ſame genus, though diſtinguiſhed by farmers into the two varieties of winter and ſpring rye, between which he has not been able to find any real difference, after cultivating them ſeveral years on the ſame land.

The winter rye, which has the largeſt grain, is what the generality of farmers cultivate. It is uſually ſown in autumn, at the ſame time as wheat; and in many of our northern counties, as well as in Wales, they are often mixed and ſowed together, though, as Mr. Miller thinks, this muſt be very bad huſbandry, becauſe the rye will always ripen ſooner than the wheat; ſo that, if the latter be let ſtand till it is fully ripe, the former will ſhatter: nor can this be practiſed where the people are not accuſtomed to eat rye bread: for, though ſome account it good when mixed, it is ſo very clammy, that few who have been uſed to be fed with wheat will ever rightly reliſh it.

Rye is generally ſown on poor, dry, gravely, or ſandy land, where wheat will not thrive; and in ſuch places it does very well: but it would not be right to ſow this grain on land which will bear wheat, becauſe the value of rye is greatly inferior. The ground ſhould be dry when it is ſown: for if much rain falls even after the ſowing, before the rye is come up, it often rots in the earth. It, indeed, riſes in a much ſhorter time than wheat. When ſown upon light land, it ripens much earlier than on cold ſtiff ground, and by continuing to ſow it in ſuch a ſoil during two or three years, it will be forwarded ſo much

[1] *Gardener's Dictionary*, Art. SECALE.

as to ripen a month earlier than that which has been long raiſed upon ſtrong cold ground. For this reaſon, thoſe who are obliged to ſow rye toward ſpring, generally provide themſelves with this early ſeed. A little ſprinkling of dung or mud, though it be but half the quantity commonly uſed for other corn land, will, if laid upon the rye ground, greatly advance the crop. The uſual allowance is two buſhels of ſeed to a ſtatute acre, or, if it be new broke up ground, or land ſubject to worms, about a peck more; and the produce commonly is about twenty buſhels upon an acre. In the ſummer of the year 1699, which was uncommonly dry, Mr. Mortimer reckoned [k] ninety grains apiece in ſeveral ears of rye.

The ſmall rye may be ſown in the ſpring, about the ſame time as oats, and uſually ripens as ſoon as the other ſort: but if the ſeaſon prove wet, it is apt to run much to ſtraw, and the grain is generally lighter than the other. The chief uſe of this ſort is to re-ſow lands where the autumnal crop has failed.

This corn is ripe when it's ſtraw turns yellow, it's ear hangs, and it's grain is hard. It is not very apt to ſhed; and therefore, if it be weedy (though this ought never to be the caſe with any corn), it ſhould be let lie upon the ground, or gavel, as ſome call it, a week or ten days after it is cut, if the weeds do not dry ſooner, before it be bound up; for otherwiſe thoſe weeds will give in the barn, make the rye not thraſh well, and render it muſty. But as this grain will grow in the ear ſooner than any other, if it be wet, particular care muſt be taken, eſpecially if rain comes on, to turn it at leaſt once in two or three days, and lay the ears upon the ſtubble, as high above

[k] *Vol.* I. *p.* 124.

the ground as can be. This will help to preſerve it from hurtful moiſture: but if it be cut in perfectly dry weather, and without weeds, it may be houſed as it is reaped.

The general uſe of rye is for bread, either alone, or mixed with wheat, in which ſtate it is called *Spelt*, or *Meſlin* corn. It alſo yields a ſtrong ſpirit when diſtilled; and, if ſowed only for dreſſing of land, is of vaſt ſervice to the ground where it is plowed in green and ſucculent. The truly worthy, and reverend Dr. Eliot informs us[1], that he has not only been told, but knows by his own obſervation, that if rye be ſowed ſucceſſively every year upon the ſame land, both the crop and the land will be greatly improved; in ſo much that ſome grounds which would yield but five buſhels to the acre at firſt, have, in time, afforded a crop of fifteen buſhels to the acre, without the charge of dung, or any manure.

This plant is likewiſe ſown in autumn to great advantage, purpoſely for green feed for cattle, particularly for ewes and lambs in the ſpring, before there is plenty of graſs: When this is intended, the rye ſhould be ſown early, that it may have ſtrength to furniſh early fodder. In this light, it ſupplies the want of turnips where they have failed, or where their ſeaſon is over: ſo that, in ſuch caſes, it is very good huſbandry to ſow the land with rye, eſpecially where there are ſtocks of ſheep, which cannot be well ſupported without green food early in the ſpring. The farmer who has many ſheep ſhould conſider, that turnips are always a very precarious crop; and therefore he ſhould, beſide ſowing ſome places with cole-ſeed, in order to have green fodder, ſow rye in others, to guard againſt accidents. If ſome of the ground

[1] *Eſſays on Field Huſbandry*, *p.* 60, laſt Edition.

ſowed

ſowed late with turnips, which have failed, be ſown in the autumn with rye, he will find it turn to good account. To have green food for cattle in April, which is the ſcarceſt time of all the year, ſome ſplit the ridges of their wheat ſtubble, and and ſow them with rye, allowing about a buſhel to an acre, which they harrow in, and feed about April, or when they want it; and in May they plow it up for a fallow [m]. But it certainly is extremely wrong ever to turn cattle of any kind into a rye-field, to feed there; becauſe, beſides doing the ſame injuries as they would to young wheat, ſheep, eſpecially in open weather, would make a multitude of little holes in the ground, and water would ſtand in them, to the great detriment of the rye, which cannot by any means bear wet. Even in Leiceſterſhire, where they abſurdly winter-feed their wheat by conſent, they never feed their rye, becauſe it is too tender to bear it [o].

Both wheat and rye may be cut ſomewhat before they are thoroughly ripe, eſpecially if they be lodged; for if the ſtraw be broken, it will no longer convey any nouriſhment to the grain [n]. M. Duhamel ſeems to think this even the moſt eligible way for wheat, becauſe the grain will harden afterwards in the ſheaf; whereas, if it be let ſtand till it is too ripe, it will ſhed greatly in cutting, binding, and carrying home. It is partly to prevent this inconvenience, that good huſbandmen tie it in the evening, and carry it off early the next morning. The ancients reaped their corn before it was full ripe, as Pliny informs us [p]. And indeed it muſt be allowed that very great

[m] MORTIMER, *Vol.* I. *p.* 125. [n] *Idem. ibid.*
[o] LISLE, *Vol.* I. *p.* 271.
[p] *Secandi tempus cum ſpica defloreſcere cœpit, atque roborari: ſecandum antequam inareſcat. Hiſt. Nat. Lib.* XVIII.

diſadvantages neceſſarily attend the letting of ſome ſorts of corn ſtand till their grains have acquired their utmoſt maturity. Both the chaff and the fodder are the worſe for it; and, if ſuch ripe corn takes wet, the increaſe in malt is loſt, if it be barley, it having already ſpent itſelf; and if it be wheat, the quality of the flour is greatly impaired, as well as the quantity conſiderably leſſened. But if corn be cut greeniſh, it will bear a pretty deal of wet without damage; for it will not imbibe the water like full ripe corn, but only take in ſo much as to be kindly fed thereby. Again, if any ſort of corn be blighted, the ſooner it is cut down, though but half ripe, the better it will be; for nouriſhment can no longer be conveyed to it by the ſtraw; but it will be fed by lying in the ear[q]. The ſtraw would become more and more brittle, by ſtanding till the corn is ripe; and the grain comes the clearer from the huſk, when threſhed, if this blighted ſort be cut early.

One man, with a binder, may reap an acre of wheat, and ſomewhat more of rye, in a day, if the corn ſtand well: he will alſo clear about an acre of peas, vetches, &c. in the ſame ſpace of time.

The medium price of wheat, in this country, is about five ſhillings the buſhel. If it be much under four ſhillings, the farmer cannot pay his rent and live; and if it exceeds ſix ſhillings, the poorer ſort of people cannot afford to purchaſe wheaten bread. A buſhel of wheat weighs from fifty ſix to ſixty pounds; a buſhel of barley, from forty four to forty ſeven pounds; and a buſhel of peas, from ſixty three to ſixty ſix pounds.

As the laſt Volume (the 6th) of M. Duhamel's *Traité de la Culture des Terres* did not reach this

[q] Lisle, *Vol.* I. *p.* 324.

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country till after the 2d edition of my *Practical Treatiſe of Huſbandry* (modelled upon that excellent writer's former volumes) was printed off; the following extract will not only have the merit of novelty in our language, but will afford a farther proof of that gentleman's zeal to promote the eaſe and welfare of mankind. To thoſe who have felt the merit of the marquis of Turbilly's truly noble enterprizes, I need not make any apology for the length of a quotation, in which we again find the ſame admirably beneficent ſpirit; and to a lover of Agriculture, the facts will be ſufficiently intereſting.

"The huſbandman, ſays M. Duhamel[1], cannot have a more favourable ſeaſon to get in his harveſt, than that which is afforded him by hot and dry weather: for the quality of the corn is improved, and the grain is rendered much fitter to keep, by the ſun's having acted powerfully upon it, either towards the latter part of its ſtanding, or juſt after it has been cut: though it is true, on the other hand, that this very circumſtance renders the ears more apt to ſhed their grain, and that the value of a ſowing is often loſt thereby. To prevent this, as much as poſſible, the corn is firſt laid in gripps, and then tied up in ſheaves, in the cool of the evening, or early in the morning before the heat comes on; and the mowers of oats frequently work during part of the night, to avoid the exceſſively fatiguing ſultrineſs of the noon. Theſe poor people, whoſe taſk is infinitely laborious, are liable to many grievous diſorders; eſpecially the reapers, who, being obliged to ſtoop to their work, almoſt to the very point where the rays of the ſun are moſt violently reflected by the earth, breathe a perfectly burning air. This forces

[1] *Tom.* VI. *p.* 247.

them to drink copiouſly of liquors, which, being heated by the ſun, allay their thirſt only for a few moments, and, I ſtrongly ſuſpect, often occaſion ſevere illneſſes: the inventing of a machine, engine, or inſtrument, by which the hardneſs of this labour might be mitigated, would therefore be a truly uſeful diſcovery; and I moſt heartily exhort all ingenious perſons who have a mechanic turn, ſeriouſly to think of it.

"The two uſual ways of cutting corn, are either with the ſcythe, or with the ſickle. The former is commonly uſed for oats and barley, or, ſometimes, for very thin, ſhort wheat; and the ſickle is generally appropriated to the reaping of tall and thick wheat and rye. The ſcythe diſpatches ſo much more work than the ſickle, that the difference of expence between reaping an acre, or mowing it, is nearly in the proportion of 5 to 2.

"Every part of the mower's body labours and fatigues, and his work requires greater dexterity than that of the reaper: but as the mower is always in a kind of ſtanding poſture, he has the advantage of being refreſhed by every breeze of air; which the reaper, for the reaſons before-mentioned, has not.

"I do not deſpair but that ſome engine may, one time or other, be found out, to eaſe theſe very hard labourers, and expedite their work. In the mean while, I am perſuaded that M. de Lil'e's following account of what he himſelf has practiſed on his own eſtate, will afford ſatisfaction to all my readers, who will be pleaſed to obſerve, that he does not relate matters of mere ſpeculation, but real facts; things actually executed by him, and which I ſhould certainly have tried, if I could poſſibly have been in the country when our harveſts were got in.

M. De

Harvesting

M. De Lille's *account of his method of mowing wheat.*

"When I first put a scythe into my corn, I was "of course laughed at by some of my neighbours, "because they had never seen any such thing. I "let them enjoy their jokes; but persevered in "my undertaking, which I have now practised "sufficiently to be able to point out minutely it's "advantages, and it's inconveniencies; for I al- "low that, tho' the former are very great and "numerous, it is also attended with some of the "latter."

"The year 1751 was very rainy; our grass "rotted upon the ground, our corn was poor and "infested with weeds; and the weather continued "extremely bad during all the harvest season. "One of my fields of wheat, containing about 15 "acres, was, in particular, in such wretched "plight, that I did not think the crop worth "taking off. However, after walking over it, "and viewing it on every side, I found that the "quantity of grass and other growths upon it, "might, if mowed, afford a great deal of fodder, "which would make me some amends for the "total loss of my lucerne. I therefore determined "to let my horses have it all, with the little wheat "which appeared here and there. This first made "me think of mowing a field of wheat; though I "soon recollected that I had met with the hint be- "fore, in some of your writings. Accordingly, I "set my mowers to work: my field yielded a "great quantity of fodder; the grass, mowed "within two inches of the ground, shot up anew, "and afforded excellent pasture; and lastly, my "bailiff, more saving than I had been, ordered "the trusses to be thrashed, and got out of them "as much wheat as was yielded by other "grounds.

"Whilst

" Whilſt I was congratulating myſelf upon the " ſucceſs of my operation, by which my horſes " and cattle were provided with plenty of fodder " for the next winter, I learnt that the huſband- " men in Hainault, Flanders, Artois, and other " adjacent parts, never cut their corn down other- " wiſe than with a ſcythe; but at the ſame time I " was informed, that they do not mow wheat in " the ſame manner as oats; that the ſcythes are " not made alike for both theſe works, and that " there are ſome other eſſential differences.

" Theſe obſervations were a ſort of proof that " the practice had been found to anſwer, ſince it " was ſtill continued; and I concluded, that if my " operation, imperfect as it was, had ſucceeded ſo " well, I might expect far greater advantages " when it ſhould be performed regularly: but, " not to be too ſtrongly prejudiced in its favour, " I reſolved to make a trial upon about 30 acres " only.

" By dint of inquiry, I found within a few " miles of me a huſbandman who came from the " province of Artois, and had been uſed to this " very buſineſs. I talked with him; he told me " how the work ought to be done, pointed out " it's advantages, and I retained him for my in- " intended next year's mowing of wheat: but as " the ſeaſon was pretty far advanced, and there " was not time to procure from his country other " people equally well acquainted with the practice, " to follow the ſcythe, and do the whole com- " pletely in every reſpect, he inſtructed two " young lads, as well as he could. In ſhort, nothing " was wanting but a mere matter of form, by the " neglecting of which ſome of the lifts of the cut " corn were miſplaced, ſo that there were ears at " both ends of the ſheaf.

I ought

Harvesting

" I ought not here to forget the clamour raiſed " by this novelty. I made the experiment upon " my fineſt wheat; becauſe my new workman had " told me, that the ſtronger the corn was, the " better and more regularly the mowing would be " performed. My neighhouring husbandmen, and " all the reapers employed by them, thought me " out of my ſenſes, and ſome of them even came " to reaſon the matter with me. They meant " well, and I took it kindly; but deſired them " carefully to notice the event.

" My experiment was made upon three pieces " of wheat, of 10 acres each, ſituated in much " more extenſive fields of the ſame corn; ſo that " there was the faireſt room to make a juſt com- " pariſon between the operation of the ſcythe and " that of the ſickle.

" Some of the neighbouring husbandmen had " the curioſity to ſee the work performed, and " were ſurpriſed to find that leſs corn was ſhed in " this way, than in the common practice of reap- " ing with the ſickle. They thought the method " good; but made a few objections to ſome par- " ticular circumſtances, in which the experience " of ſubſequent years ſhewed them that they were " wrong. Their entire approbation then followed; " and their mowers, finding that they ſhould be " able by this means to cut down all their corn " without the aſſiſtance of ſtrolling ſtrangers who " often do their work very badly, gladly learnt the " new method, and commended it to others.

" This trial ſucceeded ſo well, that I reſolved " to cut all my crops in the ſame manner; and " that nothing might be wanting to perfect my " mowers in this practice, I procured a ſufficient " number of expert workmen, maſters of the art, " from the village of Trie, near Valenciennes, to

aſſiſt

" aſſiſt and inſtruct them for the harveſt of
" 1753.

" This work required a precaution which has
" been duly attended to ever ſince: it is, to pick
" all the ſtones from off the land, every year, as
" carefully as poſſible. The expence of ſo doing
" is a very trifle, when compared to the advan-
" tages attending it. All the roads around my
" land, which were formerly impaſſable in winter,
" are now firm and good, fit for any carriage.
" We no longer hear of horſes lamed, or wag-
" gons overturned by them; and, which is equally
" true, I find that my ground now requires a leſs
" quantity of ſeed.

" I have now practiſed this method, in an ex-
" tenſive manner, during five ſucceſſive years, in
" the courſe of which I have had opportunities of
" experiencing every circumſtance neceſſary to be
" conſidered in order to determine it's real merit:
" I mean, mowing in rainy weather, and cutting
" of corn either bent, laid flat, totally lodged, or
" lodged only in particular places, and in various
" directions. I ſhall firſt deſcribe the mechaniſm
" of this mowing, and then point out it's advan-
" tages, with the objections of my neighbours,
" which will ſhew the only inconveniencies I have
" met with.

" The Flemiſh mowers whom I employed in the
" year 1753, brought with them ſcythes exactly
" like ours. I ſaw no ſort of difference in their
" ſize, make, manner of being mounted, or even
" in the hooks they were trimmed with: ſo that
" I found I had been miſinformed by thoſe who
" told me in 1751, that this work required an
" inſtrument different from that which is uſed for
" mowing oats. It was not till the year 1755,
" that an ingenious workman pointed out ſome

" very

" very proper alterations, which have ſince been
" made.

" This intelligent mower obſerved, that the com-
" mon ſcythe cannot ſuit any ground but ſuch as
" has been plowed flat; that it therefore was leaſt
" of all proper for our lands, which are plowed in
" ridges of ten or twelve furrows, raiſed very high
" in the middle; and that its hooks broke the ſtraw,
" plucked off numbers of ears, and did not lay
" hold of many ſhort plants which grow in the
" bottom of the furrows, whereby a loſs was occa-
" ſioned, or take up the intermixed graſs and
" weeds ſo exactly as might be wiſhed. To re-
" medy this, he took a ſcythe at leaſt ſix inches
" ſhorter than thoſe which are commonly uſed,
" and, inſtead of the hooks, ſubſtituted what he
" calls the *bender*, conſiſting of two ſhoots of
" willow, or other green wood, placed ſemi-cir-
" cularly upon the handle of the ſcythe, where the
" hooks are commonly ſet. To this end, there
" muſt be four holes in the handle, ſo that the
" end of one twig may be put into the lowermoſt
" hole and it's other end into the third, and the
" two ends of the other twig into the ſecond and
" fourth holes. The ſcythe thus trimmed is to
" be uſed in the manner I ſhall now explain.

" When a mower ſets about cutting down a
" crop of oats, he places himſelf ſo that the
" corn is at his right-hand, from whence the
" action of the ſcythe throws the waving towards
" his left. The mower of wheat, on the con-
" trary, proceeds from outſide to inſide, ſo that the
" corn which he is next to cut is always at his left
" hand; and that which he has juſt cut, being
" collected by the bender, is reſted, inclining a
" little, againſt the adjoining uncut part.

" A helper, which may be a boy of 12 or 15
" years of age, or an elderly woman, follows the
mower

" mower at the diſtance of four or five feet, with " a reaping hook, or a ſtick about a foot and a " half or two feet long, and, by putting that " through the interval between the ſloping late " cut wheat, and the ſtanding corn againſt which " it reſts, takes up the former, gives the ſtraw " ends a gentle ſtroke or two upon the ground, " to form that parcel into a grip, and lays it down " at his right hand. This ſhould be done very " expeditiouſly, becauſe the *picker-up*, as this per- " ſon is called, is followed by another mower; " and it ſhould alſo be done dexterouſly, becauſe " the greater or leſs quantity of gleanings depends " thereon. There ſhould be as many pickers-up " (we call them binders), as there are mowers.

" The poſture of the mower is a circumſtance " of ſuch importance, that I think myſelf happy " in having taken particular notice of it in 1754. " In cutting graſs and oats, the mower goes in " ſuch manner that his feet, which are moved alter- " nately at each ſtroke of the ſcythe, deſcribe two " parallel lines. But in the mowing of wheat, " the mower's track ſhould be upon a ſingle " line, ſo that his right foot, which ſhould be " foremoſt, be driven forward by the left, at each " cut of the ſcythe; not unlike the attitude of a " fencer when he advances.

" An accident, which had like to have over-ſet " my whole operation in the year 1754, demon- " ſtrated to me the neceſſity of this different poſ- " ture. I employed for mowing my wheat, men " who uſed to come yearly to cut down my oats: " they were ſeven in number. On the third day " of their labour, five of them fell ill; upon which " I ſet three others to work: but the conſequence " was, that I had ten ſick people to take care of " at the end of the week. I viſited them, in- " quired into their ailments, and found, that

" ſome

" ſome of them had a fever, but that all com-
" plained of violent pains and ſoreneſs under their
" left ribs. At firſt, I inclined to think them
" pleuritic; but, upon a cloſer examination, and
" upon conſidering the nature of the work they
" had been at, I ſaw that their illneſs proceeded
" from badly managed hard labour, the ſtreſs of
" which had been made to lie chiefly upon the
" left ſide. I therefore ordered them to take
" their reſt.

" The next day, upon viſiting my infirmary, I
" found that two of the mowers were returned to
" their work. I went out to them, and ſaw, even
" at ſome diſtance, that their poſture in this work
" was the ſame as if they had been mowing of oats.
" This immediately ſhewed me the cauſe of their
" pains. The ſcythes which they then uſed had
" the common ſort of hooks, and were much hea-
" vier that thoſe with only wicker benders. I took
" up one of them, put myſelf in the poſture of a
" mower of oats, and ſhewed them, that as a much
" greaterweight reſted upon the hooks of the ſcythe
" when they mowed wheat, then when they cut
" oats; it was not poſſible for them, in the poſture
" they had choſen, to move that increaſed load to
" the left, without an irkſome twiſting of the
" body. Then, putting myſelf in the poſture of
" a fencer, as I had ſeen my Flemiſh mowers do
" the year before, I demonſtrated to them, that
" the body was thereby placed in ſuch an attitude
" as enabled it to exert the greateſt ſtrength,
" when, by the motion from right to left, it had
" the greateſt load to ſupport, and that, by the
" ſame means, this load was carried round with-
" out fatiguing the ribs of either ſide. My man
" took back his ſcythe, tried as I had directed,
" was convinced of the truth of my demonſtra-
" tion, taught his companions the ſame method,

" and

" and they have done their buſineſs eaſily ever
" ſince. I thought it neceſſary to relate the circum-
" ſtances of this accident, becauſe I am ſatisfied
" that even the ſtrongeſt men would ſink under
" the labour of mowing wheat, if they were to
" ſtand in the ſame poſture as the mowers of
" oats.

" Such is the manner in which this operation
" ſhould be performed, when the corn ſtands up-
" right, that is to ſay, in the moſt favourable years.
" I ought to add, that the mower ſhould take care
" to place himſelf, for his work, in ſuch man-
" ner that his left hand may be toward the wind.
" The corn is then naturally inclined over the
" ſcythe, and is the more eaſily cut cloſer to the
" ground. The reſiſtance of the wind, be it ever
" ſo little, helps to keep the corn which is cut
" ſteady upon the benders of the ſcythe, and faci-
" litates the motion which reſts it againſt the un-
" cut corn, where the binder takes it.

" The mower is not hindered from mowing
" cloſe, by the wind's blowing at his back; but
" the corn which he cuts will not be ſo exactly
" collected by the bender: ſome of the ears will
" be a little ſcattered: but the greateſt inconve-
" nience is, that it does not reſt ſo well againſt
" the ſtanding corn, but is often blown down;
" which renders the binder's work ſlower, and
" more troubleſome, and occaſions greater glean-
" ings.

" The wind is in a bad corner for the mower
" when it blows in his face. It then occaſions a
" loſs of ſtubble, and a great diſperſion of the
" ears.

" But the worſt of all winds for this work, is
" that which blows upon the right hand of the
" mower. The ſtubble then remains long, and
" ſo great a quantity of ears lies ſcattered about,

" that

" that one would hardly think the ground had
" been harveſted. My mowers did not place
" themſelves in this manner of their own accord;
" but I made them do it for a quarter of an hour,
" to try the effect, of which I am fully con-
" vinced.

" When the corn is inclined, or bent, the
" mower takes it in the direction of it's bending,
" from left to right; which has the ſame effect,
" in calm weather, as if the wind blew towards
" his left.

" Corn which is lodged cannot eaſily be mowed
" inward, becauſe the binder would be inceſ-
" ſantly impeded by the intangling of his grip
" with the un-cut corn. A good mower judges by
" his eye, which part it is moſt proper to begin
" at, and takes advantage of the wind when it can
" be of ſervice to him. The method which I
" have ſeen moſt commonly practiſed, has been
" by taking the corn in the direction of it's bend-
" ing, and throwing it in waves. The work thus
" done is neatly performed: no remains of ſtub-
" ble are ſeen after the mowing; but the field
" looks like a meadow.

" Corn laid abſolutely flat, and intangled, is
" the moſt difficult to cut well. I have ſeen a
" mower take it in every various direction in
" which it was beaten down, as if the wind had
" been conſtantly at his back, and by this means
" he has cut as cloſe as if it had been only lodged.
" My wheat was in this condition in the year 1757,
" and was mowed very regularly: only the work
" was ſomewhat longer about, than it generally
" is in other caſes.

" I ſhall not ſpeak of rainy ſeaſons till I come
" to the objections againſt this method of cutting
" corn; becauſe they have nothing to do with
" our mowing, and the only thing requiſite in

" ſuch caſes is to keep the corn from ſprouting
" in the ear: but I ſhall here relate the advan-
" tages which I find in this practice.

" The preſervation of my fellow creatures is
" ſo dear to me, that I look upon the means of
" leſſening their exceſſive hard labour at a time
" when the heat alone is enough to over-power
" them, as the firſt and greateſt advantage reſult-
" ing from this method. Now I ſee that a good
" reaper, with his ſickle, can ſcarcely cut an acre
" of wheat in a day, let him toil ever ſo much;
" whilſt the mower will diſpatch from an acre and
" a half to upwards of two acres, according to
" his ſkill and dexterity. I have, indeed, met
" with but few able to exceed two acres, when
" they have done their buſineſs well: but we may
" reckon that a good mower, taking them one
" with another, and the corn as it runs, upright,
" lodged, intangled, &c. will clear an acre and a
" half, or perhaps an acre and three quarters, in
" a day, neatly, and without waſting any of it.
" This mower does then three fifths more work
" than a reaper can. 'Tis true, he has not the
" grips to tie up, becauſe the perſon who follows
" him does that part: but he is obliged to whet
" his ſcythe when he comes to the end of the
" field, and ſtill oftener when the corn does not
" grow thick; beſides which, notwithſtanding all
" the care that can be taken to clear the ground
" of ſtones, not a day will paſs without his meet-
" ing ſome, which will oblige him to have his
" ſcythe new hammered; and laſtly, when he has
" finiſhed a row, he muſt go back to the other
" end of the field before he can begin another.
" All this takes up at leaſt as much time as the
" reaper's binding up what he has cut: and
" in regard to the hardneſs of the labour on
" each ſide, I believe that every one who rightly

conſiders

"considers the nature of their respective works, "and their postures in working, will allow, that "the mower's toil and fatigue is three fifths less "than that of the reaper.

"Another circumstance, well worth attending "to, in this method, is, that the mower is not "exposed to those injuries from thistles, thorns, "and other noxious plants, which often prove "fatal to the reaper.

"From the first of these advantages result "several benefits: 1, a greater riddance of the "necessary work. Not a year passes without the "husbandman's experiencing that some part or "other of his corn ripens too suddenly; and this "unexpected maturity, being exceedingly height-"ened by the least delay, occasions a great waste, "by the shedding of the grain, both when the "crop is reaped with the sickle, and in loading "and un-loading it when carried home: whereas "the scythe, by clearing in two days a field which "could not be reaped in less than five, in the "common way, guards against that excessive "ripeness.

"2. This method of cutting down the corn "requires fewer workmen. —— I must here ex-"plain myself; because the fact would contradict "me, if it be objected that a mower and a binder "are necessary in this way, for what the reaper "alone does in the other. But I consider, that to "harvest ninety acres, for example, of wheat, I "must employ ten men at least twenty days, with "the sickle; whilst seven mowers, and their "binders, (14 people), easily do my business in "ten days. The difference then is equal to sixty "days work of one man: and if I do not intend "to get my harvest in quicker with the scythe "than with the sickle, I take but four mowers "and four binders, eight persons, of which the

" four laſt ſtand me in leſs expence than three " reapers; becauſe I employ for this buſineſs " young people, who would not be ſtrong enough " to reap with the ſickle. Conſequently I have two " workmen the leſs, and ſome advantage in the " compariſon between the grown-up man, who " has a higher price, and the lad, who anſwers my " purpoſe.

" 3. The thus employing of children, old " women, and men whoſe conſtitution is not ro- " buſt, would be an advantage to the inhabitants " of the place. It would afford the means of ſub- " ſiſtance to a greater number of people, and pre- " vent idleneſs and beggary; an important object " upon many accounts. Almoſt every pariſh " would find within itſelf hands enough to get in " it's harveſt, without being obliged to have re- " courſe to accidental paſſengers, who often work " badly, require exhorbitant wages, and ſome- " times leave their maſters in the middle of the " harveſt, if they do not ſubmit to their uncon- " ſcionable demands.

" Let us leave ſpeculation, and notice ſome ad- " vantages which are evident beyond contradic- " tion. 1, It is not a ſmall one to have a greater " quantity of ſtraw, and that ſtraw intermixed " with more graſs and other fodder, than when " the corn is reaped in the uſual way. This does " not need any proof; for every one knows, that " the ſcythe cuts as cloſe to the ground as the " mower pleaſes. Experience has ſhewn me, that " the ſtubble has not been left two inches long " upon our mowed fields, where the ſtones had " been carefully picked off; whilſt the ſickle " generally leaves it eight or nine inches long, " and ſometimes much more when the ground is " infeſted with thiſtles and other ſtubborn growths, " which make the reaper lift up his hand to

" avoid them. The ſtraw is therefore plainly ſix " inches longer when cut with the ſcythe, than " with the ſickle; a difference which may be " valued at a ſixth part more than that which is " uſually reaped in the common way.

" 2. The green fodder in the mowed fields " ſhoots up anew when cut, and affords excellent " paſture after the corn is taken off. The ſame " demonſtrative evidence as before, will again " take place here with thoſe who but conſider, " that the reaper, leaving the ſtubble either eight " or nine inches long, takes off only the very " tips of the graſs which chances to be within his " grip; ſo that, being then near it's time of ma- " turity, it ripens it's ſeeds, ſows them, and " withers away: whereas, when the ſcythe cuts " it within two inches of the ground, in it's " greeneſt and moſt un-ripe part, the yet remain- " ing eyes, and the crowns of the roots, ſend " forth new ſhoots, which form a good after- " crop for cattle.

" 3. The paſture upon fields mowed with the " ſcythe, is attended with an advantage, in regard " to cows, which may perhaps be peculiar to my " country. I know not whether it be the ſame " elſewhere. We find every year, and I have al- " ways taken particular notice of it, that our cows " ceaſe to yield milk during the firſt week of their " feeding among the wheat ſtubble. I take the " reaſon of this to be, that the ſtubble gets into " their noſtrils, pricks them, hinders them from " feeding, and makes them range the whole field " over in queſt of graſs unattended with this irk- " ſome inconvenience; ſo that they ſpend their " time in running about, without grazing. I do " not find that this accident happens to cows " which are turned in among the ſhort ſtubble " left by the ſcythe: the graſs there ſoon ſhoots

" up a-new, and yields me plenty of paſture,
" eſpecially if a little rain happens to fall after
" harveſt.

" It reſults from hence, that the huſbandman
" is enabled to feed more cattle than he could
" otherwiſe do, to ſave his ſainfoin or lucerne, and
" to have a greater quantity of dung; as I have
" experienced with almoſt incredible ſucceſs.

" I now proceed to the objections, which I ſhall
" ſtate in the ſame order as they were made; that
" is to ſay, as each year gave room for one or
" other of them.

" The firſt was, that the ſcythe muſt make the
" corn ſhed very much by ſhaking it conſiderably.
" To affirm the contrary may ſeem paradoxical;
" though the aſſertion will be proved from mani-
" feſt principles, and by facts. To judge rightly
" of my propoſition, it will be neceſſary to com-
" pare the operation of the ſcythe with that of the
" ſickle; both of which I have examined very
" attentively.

" The reaper preſents his hand to the corn,
" and with wide extended fingers, graſps as much
" as he poſſibly can; after which, to bring the
" lower part of the ſtalks ſo cloſe together that
" the ſickle may encompaſs the whole of his
" grip, and at the ſame time to give it a tenſion
" which renders the action of the ſickle more
" certain, he gives it a violent ſhake, and at that
" inſtant cuts it. The grip thus cut is generally
" intangled with the ſtanding corn; or the reaper,
" when going to lay it down, finds that he has
" miſſed cutting a ſtalk, or perhaps more, which
" he then breaks with a jerk of his hand. Thus
" ſeveral ſhakes precede, that which the corn re-
" ceives afterward when it is tied up.

" The ſcythe has not theſe effects. I have
" already explained the mechaniſm of it's opera-
" tion,

" tion, and ſhewn that the corn, cut without any
" violent ſhake, is carried gently by the bender
" (or *cradle*, as we more commonly call it) upon
" the ſcythe, to the ſtanding corn, againſt which
" it reſts inclined, till the binder takes it away to
" tie it up.

" To prove my propoſition by facts, I inſtance
" the following. After my wheat was mowed in
" the year 1752, in the manner before related,
" upon the three ſeveral ſpots of ten acres each,
" which were parts of much larger fields, I went,
" with four other perſons, purpoſely to examine
" with all the care we could, what quantity of
" grain might have been ſhed by the mowing.
" We found none at all in the two firſt mowed
" pieces; but a great deal in the other parts of
" the ſame fields which had been reaped with the
" ſickle. In the laſt piece, which was not cut till
" the corn was riper, we found a little grain in the
" mowed part, but incomparably more in the
" other. I did not repeat this ſearch every year
" with the ſame care, becauſe I had not always the
" ſame conveniencies of making a compariſon:
" but I have ſeen enough to be certain that no
" grain is ſhed unleſs the corn be exceeding ripe;
" and that much leſs is then loſt by the ſcythe,
" than by the ſickle.

" The following more important objection was
" afterward made by a ſenſible huſbandman, who
" obſerved to me, that, in a rainy year, the corn
" cut after this manner muſt be more liable to
" grow in the ear, than that which is reaped in
" the common way, becauſe the heads of the
" grips not being ſupported here by a pretty high
" ſtubble, the wet can not well drain off; and
" that the grain will imbibe a great deal of
" moiſture from the graſs underneath, when the
" ear is beaten down upon it by rain, which will

"render it very apt to ſprout as ſoon as the ſun "ſhines upon it. I had been told how to guard "againſt this accident, but did not try themethod "till the year 1756, when it anſwered perfectly "well.

"This method conſiſts in laying the grips in a "triangular form, ſo that the head of one reſts "upon the foot of another. This operation is "neither long nor fatiguing; nor does it require, "in order to do it quick, any thing more than a "little dexterity in cloſing the triangle, by mak-"ing the foot of the third grip ſupport the ears "the firſt. The rains which fell during the "harveſt of 1756, rendering the getting in of "that year's crops extremely troubleſome, "my neighbours had a great deal of ſprouted "corn; but mine eſcaped by this method; and "what little I had, proceeded from that which "remained un-mowed when the rain became in-"ceſſant.

"With regard to the ſheaves, when bound, my "Flemiſh mowers informed me, in 1753, of their "practice when they are overtaken by laſting "rains. It is, to heap upon one another, ends to "ends, as many ſheaves as they can poſſibly cover "with one which is then opened and laid over "them. My people did not practiſe this method, "which I believe the beſt: but they ſecured my "corn by other means, which anſwer extremely "well, and are generally known.

"From the above objection my huſbandman "derived another, relative to the difficulty of "drying the graſs and weeds intermixed with the "corn, in rainy years, and the danger of houſing "the ſheaves when full of that traſh, which may fer-"ment, and be the occaſion of therotting of a whole "pile of wheat. I cannot anſwer this objection "otherwiſe than by my experience. The harveſts

"of

" of 1756 and 1757 were certainly not favoured " by the weather: yet all the wild growths which " were cut down with, and bound up among my " ſheaves, were well withered when they were " houſed. No ſort of ſmell which indicated the " leaſt fermentation was perceived in any of my " barns; the threſhers did not find any thing " that looked like it; and the ſtraw which is " taken from thoſe barns, to feed my horſes, at- " teſts that there was not any.

" I now come to the laſt objection; by ſo " much the more ſerious, as it is one of thoſe " inconveniencies which I cannot remedy, but to " which I readily ſubmit. The ears of the corn, " ſay the objectors, do not lie ſo even in your " grips, as in thoſe which are reaped with the " ſickle; ſome of them are in the middle, and " others at the very bottom of the ſheaf; ſo that " your corn is not threſhed ſo well or ſo regularly, " and you thereby loſe perhaps a conſiderable " part of it. 2, All the graſs and weeds contain- " ed in your ſheaves are threſhed with the wheat, " and their ſeeds are mingled with the corn when " the threſher meaſures it out: conſequently you " pay him for threſhing this traſh, which again " increaſes the labour and pay of the winnower.

" All this is true: but let us diſcuſs the matter " a little more thoroughly. There are ears in the " middle and at the bottom of my ſheaves: but " they ſeldom are of any other kind than thoſe " which we call backward or late ears; the weak " productions of ſickly plants, or of ſeeds not per- " fectly ſound. Repeated examinations have con- " vinced me, that very few others are in this " caſe; and theſe ears hardly part with their grain " at any time, in whatever manner they are threſh- " ed; for though the grains be torn from off " them by the action of the flail, the inmoſt huſk

ſtill

" ſtill adheres to the corn. Theſe diminutive im-
" perfect grains are ſo great a detriment to the
" fine plump, well nouriſhed corn, that they leſſen
" it's value if not carefully ſeparated by winnow-
" ing; after which they ſerve to feed poultry. If
" theſe ears eſcape the flail, the ſtraw is ſo much
" the better. Our horſes and other cattle reap
" therefrom a benefit which we ought not to
" grudge, becauſe, I think, it turns to our ad-
" vantage.

" The threſhed graſs and other wild produc-
" tions, do indeed yield a conſiderable quantity of
" what are commonly called bad or uſeleſs ſeeds,
" for the beating out of which I pay the threſher.
" But the graſs which occaſions this expence,
" ſaves me that of a great deal of ſainfoin and
" lucerne which my cattle would conſume: and
" it would be unjuſt in me to complain of the
" additional charge in the winnowing, ſince my
" manager has thought of applying thoſe ſeeds to
" domeſtic purpoſes, ſuch as feeding fowls, &c.
" which prove more profitable to me than an
" equal quantity of the fineſt corn.

" A real increaſe of expence, is what I pay the
" threſher beyond the common price of the coun-
" try. This difference, which conſiſts in two-
" pence or three-pence for a quarter of wheat, is
" but a juſt compenſation for his extraordinary
" trouble in unbinding and binding up again
" perhaps an hundred and fifty ſheaves, and ſome-
" times more, for what an hundred ſheaves gene-
" rally yield, when reaped in the common way.
" But this expence is ſo amply repaid by the ex-
" traordinary quantity of ſtraw obtained by my
" method, that I rate the difference at more than
" the value of five quarters of corn, which, to
" ſilence contradiction, I will ſuppoſe to be other-
" wiſe loſt in my practice. Still my crop is cut

" down

" down and houſed with far leſs toil and expence
" than if it was reaped.

" I reſume my anſwer to this objection, and
" ſay, that even ſuppoſing the expence of my
" harveſt to be equal to what it was before, in-
" cluding the increaſed charges in the barn, and
" the loſs of five quarters of wheat; ſtill my
" greater quantity of ſtraw ſaves me ſeveral thou-
" ſand weight of fodder, and produces plenty of
" dung, of which I daily experience the good
" effects."

Wheat which is full of weeds ought to be cut three or four days ſooner than ordinary, that the weeds may have time to wither before the corn become too ripe: for if it be not cut till the grains are full ripe, it will be liable to conſiderable damage by ſhedding, loſs of colour, and injuries from rain, whilſt it remains expoſed for the weeds to dry. A ſingle ſhower, indeed, or even a day's gentle rain, whilſt it lies in ſwarth, is thought to be rather beneficial to the grain, by making it feel dry and ſlippery, and threſh the better: but all poſſible care ſhould be taken to guard againſt it's being wetted too much. When, through any unavoidable accident, it is laid up not thoroughly dry, though it will not take much harm in the mow, it will ſweat and cling together when laid in a heap after being threſhed, and look as white, with mouldineſs, as if it had been ſtrewed with flour. Such corn will not keep, and therefore ſhould be ſent to market, and ſold, as ſoon as it is threſhed.

In Oxfordſhire, and ſeveral other countries, they bind up their wheat in ſheaves, though it be full of weeds, and ſet three ſheaves ſomewhat ſloping againſt three others, after which they cover their tops with two ſheaves opened at their ear ends, which are extended and placed downward. In

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this ſituation they let their wheat ſtand three weeks or a month in the field, before they carry it in; for no wet can hurt it, nor is it apt to grow in the ear, when thus ſheltered.

In their wheat-pooks, as they call them, in Wiltſhire, the ſheaves are ſet in a circle, with their ears uppermoſt, and another circle of ſheaves is placed upon that, and ſo on, contracting each round, till the pile ends in a point, upon which a ſheaf opened, and turned with the ears downward, is placed, like the ſhackle of a hive; for an ear turned downward will not grow, though ever ſo much wet fall upon it, and the bottom of a ſheaf being broader than it's top, every upper one ſhelves over the under, like the eaves of a houſe. A load, or two loads, may be thus put into a pook, which is a very good way to ſecure corn againſt rain, and to give the weeds among it time to dry. But, as Mr. Liſle rightly judges [m], this method is not altogether proper when the wheat is intended to be laid up in a rick; becauſe, if the weather prove wet, mice will run to it for ſhelter, and will be carried in with the pooks. It is the general way of making wheat-ricks in the iſle of Wight, without thatching.

Though moſt corn is bettered by lying a while in ſwarth, or grips, to take the dews, which contribute to render it's grain plump and of a good colour; yet it's ſtraw becomes thereby the worſe for fodder, unleſs it was cut before it had attained full maturity, and lies out no longer than till it be ſufficiently ripened.

In hot dry ſummers, when the corn ripens fully, and it's own vigour gives it a proper colour, and plumps up the grain ſo that huſks readily yield their contents when threſhed; wheat need

[m] *Obſervations in Huſbandry, Vol.* I. *p.* 333.

not

not lie out in grip before it is ſheaved, or in ſheaf, unleſs it be very full of graſs and weeds; but in cold ſummers, the wheat is horny and pale, the grains are thin and require being plumped, and their huſks cling ſo cloſe, that they muſt be mellowed, in order to make them threſh well. The full grain which ſwells the chaff, even till it opens, in good and fruitful years, lies almoſt bare to every moiſture; and the heavy ears then ſpread and hang over the ſheaf, which of courſe opens wider, and lets the rain into the bonds ſooner than in leſs kindly ſeaſons, when, the wheat being light, the ears in the ſhock ſtand more upright and cloſer together.

In proportion to the heat of the weather, greater expedition is neceſſary in reaping; for corn, when haſtily ripened, ſcorched up by the ſun, and full in grain, ſoon takes a ſtain, is damaged by wet, and eaſily ſheds at every blaſt of wind. The prudent huſbandman ſhould therefore, in ſuch caſes, employ the greater number of reapers; for he cannot deſire more, than that his corn be perfectly ripe and of a good colour: for which reaſon, the leſs it then lies abroad in grip or ſheaf, the better it will be. Cutting it high up, ſo as to avoid the intermixed graſs as much as poſſible, by which means it is the ſooner fit for carting, has been found very ſerviceable on theſe occaſions; and Mr. Liſle is of opinion [a] that, eſpecially in hilly countries corn can never be better houſed, if thorough ripe, hard, and not weedy, than by gripping and carting as faſt as it is cut down; becauſe the dampneſs which it takes by lying on the ground all night, is not eaſily removed.

[a] *Ibid. p.* 330.

It is always moſt adviſeable to turn the grips of wheat which is left out, very early after their being cut down, in order to get them dry as ſoon as poſſible. By this means they are kept the longer from ſprouting in the ear, in caſe of rain: for if dripping weather or driving miſt ſhould enſue, and continue for any time, after they have been already loaded with wet, all the art of man cannot prevent their growing: nay, even independent of other accidents, the bare weight of the ears will ſink the grips of wheat to the ground, though they they have been laid ever ſo light and hollow; and they will certainly be injured thereby, if ſuffered to lie long out in wet weather. The beſt method of guarding againſt this, is by laying them in triangles, as directed by M. de Lille [b].

A principle ſomewhat ſimiliar to this ſeems to be the reaſon why the farmers in Leiceſterſhire, and Northamptonſhire, in particular, where the land is rich, deep, lies flat, and is much incloſed, leave a very high wheat ſtubble, upon which the grips are ſupported, lie the hollower from the ground, and conſequently are the eaſier dried by the ſun and wind: for it is to be obſerved, that the fatter and richer the ſoil is, the ſooner the grips will grow after they have taken wet, if they lie upon the naked ground; much ſooner than they would, in the ſame caſe, in a hilly country, where the land is poor. Huſbandmen there, beſides eſteeming it an advantage that they can ſtow a greater number of ſhort-cut ſheaves in their barns, think the loſs of the ſtraw compenſated by the excellent thatch which they make of the ſtubble. In ſome places they mow it for drying malt.

[b] *page* 392.

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The forwarder the harveſt is, and the warmer the ſeaſon, the longer the corn may ſafely lay in the field, either in grips, or ſheaves: for this expoſure to the air, after it is cut down, mellows it, and makes it threſh better and look finer. Thus, when the wheat harveſt takes place by the middle, or at leaſt before the latter end, of July, of which we have had inſtances, there can be little danger in letting the wheat lie abroad four or five days or a week, if it be not over-ripe when cut, even though a rainy day or two ſhould come: for at that time of the year the ſun is ſo hot, the days are ſo long, the graſs ſo ſhort, and the dews generally ſo little, that the corn ſoon dries, even after a hard ſhower; whereas in the middle, and ſtill more towards the latter end of Auguſt, the rainy ſeaſon frequently begins, the dewy nights grow ſo long, the graſs is ſo rough, and the ſun's drying power ſo much abated, that, if wet weather comes on then, the corn will be much more apt to grow.

A caution which Mr. Liſle recommends[c] as ſingularly important in hilly countries, is, not to bind the grips of wheat up into ſheaves too early in the day; becauſe, in ſuch a ſituation, the grips take ſo great a damp by having laid on the ground, that, though the ſtraw, and chaffy ears may ſeem to be dry when the dew is firſt gone off, and after the ſun may have ſhone an hour or two upon them, yet there will remain an inward dampneſs in the corn, and within the ſtraw, which, if laid up in that condition, will come damp from the rick or barn at threſhing time. The afternoon is therefore certainly beſt for gripping and binding into ſheaves in ſuch countries, but ſo that this work may be finiſhed before the day is over.

[c] *Vol.* I. *p.* 329.

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The bands ſhould, however, be laid in the morning, that they may not crack; for the ſtraw will not twiſt after the ſun is up, but will be brittle, and break off below the ears. The turning of three or four of the ſtubble or bottom ends of the ſtraw to the ears of the band, helps greatly to add to it's ſtrength and toughneſs.

The bands for binding up the ſheaves ſhould not be ſpread but in fair weather, becauſe, being preſſed down by the grip or two which it is neceſſary to lay upon them to keep them in their places and prevent their being untwiſted by the ſun, they will grow ſooner than any other corn, if rain ſhould come; for they cannot dry, on account of their lying undermoſt. But though the bands muſt always be made while the morning dew is upon them, the ſheaves ought not by any means to be bound up wet: if they are, they will certainly grow mouldy.

Farmers do not always attend ſufficiently to the binding up of their ſheaves, but ſuffer the reapers, for diſpatch, to tie the bands juſt underneath the ears, inſtead of binding them at the other end; the conſequence of which is, that they will hardly hold together to be ſlung into the cart at harveſt, and will certainly be in great danger of falling to pieces before they are threſhed.

If a little rain is foreſeen in harveſt time, it is beſt to bind the grips up into ſheaves as faſt as they are made; becauſe ſmall ſhowers will wet the ſingle grips ſo much that they cannot be bound up, and thoſe ſhowers may be the fore-runners of greater rains. The ſheaves, being bound, will ſoon dry after ſuch wet. But if a hard rain is foreſeen, the beſt way is not to bind up into ſheaves, becauſe they will then be wet to the bands, and muſt all be opened again. One of Mr. Liſle's neighbours, to whom this happened,

un-ſheafed ſome of his wheat to dry it, opened it, and turned it ſo often, that the ears broke off, by which he loſt half his corn. Caution ought therefore to be uſed in this caſe, leſt by curing one evil we create a worſe [d].

All farmers agree, that rain which comes with a driving wind is the worſt of any weather for ſheaves of wheat out in the field; and that it is worſe than a downright ſoaking rain for ſuch ſheaves as are wet to the bands.

In a wet harveſt, ſmall ſheaves are beſt, becauſe, being thin at top, and falling cloſe, the rain does not ſink down into the middle of them, and ſo go through into the bands, as it is apt to do in great ſheaves, which lie broader, and take a larger compaſs. Small ſheaves are alſo beſt when many weeds are intermixed with the corn; becauſe the air, wind, and ſun, have then a greater power to dry them, than they could have if the ſheaves were large.

It has been the opinion of ſome good farmers, that, if the weather be likely to continue fair, it is beſt to lay the ſheaves, the night after the wheat is cut, one by one, flat on the ground, in order to make their ſtraw lie the cloſer together, and their ears ſtand the ſtiffer and more upright; by which means they will be leſs apt to open at the top, and rain will have the leſs power to penetrate them when laid in ſhocks.

Reapers ſhould take care, in placing their grips, to lay the ſtraw end in the furrow, and the ears out; becauſe theſe will then ſtand ſloping up, and lie tolerably dry, even though rain ſhould come: but in the other way, they would ſoon grow.

[d] *Ibid. p.* 383.

Mr. Liſle remarks in his *Obſervations* (which might have been thrown into a more regular, as well as more laconic form, before they were publiſhed, for that gentleman, certainly, never intended that his un-connected notes and memorandums ſhould appear in the manner in which he penned them merely for his own uſe), that "One of his "reapers, when he had made up ſome wheat "into ſheaves, the wheat being long-eared and "lop-heavy, ſaid, rain had not need meet with "thoſe ſheaves before they were carried home." Mr. Liſle aſked him, "Why ſo?" To which the other replied, "becauſe the ears being long and "heavy were buſsle-headed, — that is, did hang "their heads downward into the ſheaf, ſo that (in "caſe a rain ſhould run down to the bands) "neither ſun nor wind could enter in to dry them; "whereas, ſaid he, when the ears are ſhort, and "not heavy, they ſtand upright and hollow, ſo "that the ſun and air may eaſily dry them."

The ſtraw of blighted wheat, being hollow and ſpungy, is very apt to imbibe moiſture; for which reaſon the beſt way is to houſe ſuch corn as ſoon as it is tolerably dry, eſpecially if there be the leaſt proſpect of rain: for if ſtraw of that looſe texture ſhould once ſoak in wet, and ſhowery weather ſhould afterward come on, it would require much more time than other corn to dry and fit it for threſhing.

If the huſbandman has followed the directions before given in regard to plowing, he will find his land in a very looſe ſtate, even after his crop of wheat is taken off. Narrow wheels would then pierce ſo deep, as to make the increaſe of the draught extremely great; and he will grow daily more and more ſenſible of the advantages of uſing broad wheels. The carriage on which his corn is loaded, in order to it's being houſed, will not,

not, with them, ſink ſo much into the plowed field, and the conveyance will conſequently be much more expeditious.

Experience has ſhewn that wheat keeps better when ſtacked in the ear un-threſhed, than it's grain does alone, when threſhed out and laid up in granaries: beſides which, a farther advantage which attends the ſtacking of this corn, is that the huſbandman need not threſh it but as his markets or other occaſions require; whereas, if it were to remain long in the barn, he would not be able to preſerve it from rats, mice, and other vermin, which harbour in the walls, roofs, &c. of ſuch buildings.

To guard againſt theſe enemies, as well as againſt the dampneſs of the ground, which would otherwiſe occaſion great loſs (for there have been inſtances of it's rotting piles of corn to the thickneſs of a yard, or more); four, ſix, or more ſtrong poſts, according to the intended ſize of the ſtack, are driven into the ground, beams of a proper ſtrength are laid a-croſs them, and upon theſe is made a floor to ſupport the ſtack. Some farmers build theſe platforms for their ſtacks ſo high from the ground, that there is room to ſhelter their carts and other implements of huſbandry under them: and ſome again, as an additional ſecurity againſt rain and birds, erect ſides and a roof; by which means they form a kind of barn: but this is needneſs if the corn be ſtacked, as it ought to be, in ſheaves, with the ears turned inward, and the ſtraw ends outward, and the top well thatched with good wheat ſtraw, which is the beſt of any for thatching. They likewiſe cover the ſupporting poſts with tin, for about a foot in breadth from the top, to prevent the mice and rats getting up: but this method ſoon proves ineffectual, becauſe tin is very apt to ruſt, and conſequently

loſes it's ſmoothneſs. A better way, as Mr. Mortimer adviſes [f], is to cover thoſe poſts with Dutch tiles, ſuch as chimnies are commonly ſet with, becauſe they will always keep ſmooth.—Others make their ſupporters of two hewn ſtones, one of which, being about three feet high, and ſloped from the bottom where it is two feet wide, to the top where it is but a foot thick, ſtands upright, and is covered with a large flat ſtone about a yard ſquare, or, which is better, of a round form. This not only prevents rats and mice from climbing up, but is alſo a ſecurity againſt the dampneſs of the ground. — Others again, whoſe method is the beſt of all, lay a foundation of brick as wide as the ſtack is intended to be, and build round it a brick wall, about two feet high, capped with hewn ſtones, which project ſufficiently outward to hinder the aſcent of any ſort of vermin. If either rats or mice ſhould, by the help of any thing accidentally reſted againſt the ſtack, chance to climb up, and get into the corn, they will not be able to remain there long, becauſe, as they cannot live without water, neceſſity will force them down, and their former means of climbing being removed, they cannot get up again. If any of them chance then to be left in the ſtack, they will ſoon die there for want of drink.

Particular care ſhould be taken, in the ſtacking of wheat, always to lay the ear-ends of the ſheaves inward and upon a riſe, ſo as to keep the middle of the ſtack full while it is worked up: for in this caſe, when it ſettles, the ſinking will be chiefly on the outſide, which will thereby be made to lie the cloſer, and the ſtraw ends being outward, and inclining downward, birds cannot get at the grain, nor can rain be driven up to the

[f] *Vol.* I. *p.* 142.

ears.

ears. The ſhorteſt and thinneſt ſheaves ſhould be uſed in the topping of the ſtack, becauſe it cannot be ſo conveniently drawn in and narrowed with great long ſheaves. They ſhould be taken from off the ſame ground, if the huſbandman wants to keep any particular ſort or growth of corn pure and unmixed. Where leſs nicety is obſerved, oats, or ſome other kind of coarſe grain, are frequently laid on the top of the ſtack of wheat, under the thatch, the better to preſerve it from being wet. Wheat, properly ſtacked will keep in perfect order for many years.

Mr. Liſle, who does not approve of ſtacking any corn but wheat [g], when room can be found for it in the barn, thatched a long rick of vetches, brought up ſharp, with barley ſtraw, to the thickneſs of three feet, and yet found upon cutting it, that the rain had penetrated through this thick covering, and done conſiderable damage to the vetches. He imputes this [h], firſt, to barley-ſtraw's being more woolly and ſpungy than wheat-ſtraw, which is cloſe and hard; and ſecondly, to the ſtack's having ſweated and heated pretty much, in which caſe the covering of ſtraw is always hollowed and ſoftened, and conſequently rendered the more apt to admit and retain wet.

The ſtalks of oats are naturally ſo ſmooth and ſlippery, that they are apt to ſlide in the ſtack, which then frequently tumbles down, eſpecially if this corn was very dry when carried in. An oat rick muſt therefore not be widened, by any means, beyond it's foundation, which generally is of faggots, nor ſhould it's ſides ever bulge out, but, on the contrary, they ſhould be gradually contracted. Barley, having a rough ſtem, may be piled more upright.

[g] *Vol. I. p.* 348, [h] *Ibid. p.* 350.

When ſparrows rooſt at night in holes, under the eaves of a ſtack of corn, it is reckoned a ſure ſign that there are neither rats nor mice in the rick; for their ſqueaking and running about in the night, would diſturb the birds ſo that they would not ſtay there.

ARTICLE II.

Of the Culture of Spring Corn.

Wheat.

SPRING, or as ſome call it, *Summer* wheat, is ſowed the earlieſt of all the grains commonly diſtinguiſhed by the appellation of *Spring-Corn*, ſo named from the ſeaſon in which they are ſown. As the grain of this is ſmaller than that of the other ſort, and it yields a leſs abundant crop, farmers never chooſe to ſow it, except when, by any accident, they looſe the proper ſeaſon of ſowing their winter wheat. Their culture is alike in all reſpects, and they ripen at the ſame time. From the latter end of February to the middle of March, and ſometimes even a little later, is the uſual ſeaſon for this ſpring ſowing.

Summer wheat has this advantage in countries where the winter is very ſevere, that it is not ſubject to blight: for which reaſon Dr. Eliot very prudently adviſes[1] the ſowing of both in ſuch climates.

It cannot, however, be expected that theſe late ſowings ſhould produce plants quite ſo vigorous as thoſe which remain four or five months longer in the earth, or that they ſhould tiller equally: but their crops will be very good, if properly managed.

The ſoil ſhould be ſomewhat drier for wheat ſown in the ſpring, than for the ſame ſort of grain

[1] *Eſſays upon Field-Huſbandry in New-England, p.* 53.

planted

planted in Autumn; and it will be better ſtill, if it be ſomewhat richer.

Wheat is the beſt and wholſomeſt of all grains, and the moſt generally uſed in England, for bread. It yields a very ſtrong ſpirit, as our diſtillers have too much experienced; and, if malted, which our laws forbid, and mixed in a ſmall quantity with other malt, adds greatly to the ſtrength of beer, as well as to it's keeping, but renders it's taſte more luſcious. A little wheat bran boiled in our ordinary beer, will make it mantle in the cup when it is poured out; which ſhews with what a rich ſpirit this grain is indued, ſince ſo much remains in the bran. It is a principal ingredient in the making of mum *. Starch alſo † is made of muſty, unwholſome wheat †.

Spelt,

* The proceſs of making Mum, as recorded in the Townhouſe of Brunſwick, the place of moſt note for this liquor, is as follows:

Take 63 gallons of water that has been boiled to the conſumption of a third part; brew it with ſeven buſhels of wheaten malt, and one buſhel of ground beans: when it is tunned, let not the hogſhead be too full at firſt; and as ſoon as it begins to work, put into it of the inner rind of fir three pounds, tops of fir and birch each one pound, carduus benedictus three handfuls, flower of roſa ſolis one handful or two; burnet, betony, marjoram, avens, penyroyal, wild thyme, of each a handful and a half; of elder-flowers two handfuls, or more; ſeeds of cardamum bruiſed thirty ounces, barberries bruiſed one ounce: put the herbs and ſeeds into the veſſel when the liquor has worked a while; and, after they are added, let the liquor work over the veſſel as little as may be; then fill it up: laſtly, when it is ſtopped, put into the hogſhead ten new-laid eggs unbroken or cracked, ſtop it up cloſe, and drink it at two years end.

Our Engliſh brewers uſe cardamum, ginger, and ſaſſafras, inſtead of the inner rind of fir; and add alſo walnut-rinds, madder, red ſanders, and elecampane.

CHAMBERS's *Cyclopædia*, Art. MUM.

† MORTIMER's *Huſbandry*, *Vol.* I. *p.* 330.

† Thoſe who require very fine ſtarch, do not content themſelves, like the ſtarch-men, with refuſe of wheat; but uſe the fineſt grain. The proceſs of making it as follows:

Spelt.

Spelt, though commonly reckoned a ſummer corn, is ſowed either in autumn, or in the ſpring, at the ſame time as wheat and rye. This grain, of which there are two ſorts, one with a ſingle, and the other with a double chaff, though both have always two ſeeds in each huſk, was formerly much eſteemed in Italy and Egypt, and is now very common in Germany[l], where they make of it bread, which is very nouriſhing and well taſted, but hard to digeſt. They likewiſe brew beer from it in ſome places. It was of this grain that the ancients made their frumenty, of which they were very fond. Though commonly ranked as a ſpecies of wheat, which it is not unlike when growing, it's grain is ſmaller and of a blackiſh hue, it's ſtalk thinner and leſs firm, and it's ear flat and bearded, with ſeeds only on each ſide. Some writers diſtinguiſh a third ſort, by the name of *white-rye*[m],

The grain, being well cleaned, is put to ſteep in veſſels full of water, which are expoſed to the ſun, when in it's greateſt heat; changing the water twice a day, for the ſpace of eight or twelve days, according to the ſeaſon. When the grain burſts eaſily under the finger, it is judged to be ſufficiently ſteeped. That done, it is put, handful by handful, into a canvas bag, to ſeparate the flour from the huſks, which is done by rubbing and beating it on a plank, laid acroſs the mouth of the empty veſſel that is to receive the flour.

As the veſſels are filled with this liquid flour, there is ſeen ſwimming a top, a reddiſh water, which is to be careſully ſcummed off from time to time, and clean water is to be put in it's place; which, after ſtirring the whole together, is alſo to be ſtrained through a cloth or ſieve; and what is left behind put into the veſſel with new water, and expoſed to the ſun for ſome time. As the flour thickens at the bottom, the water is drained off four or five times, by inclining the veſſel, but without paſſing it through the ſieve. What remains at bottom is the ſtarch, which is cut in pieces in order to be got out, and left to dry in the ſun. When dried, it is laid up for uſe.

Id. ibid. Art. STARCH.

l CONRAD. HERESBACH. *de Re ruſtica, p.* 112. *Maiſons Ruſtiques, Tom.* I. *p.* 621. m *Id. ibid.*

which

which they take to be the *olyra* of the Greeks and Latins, and ſeems to be what Mr. Mortimer calls "*Tritico-Speltum*[n], a ſort of naked barley, or "wheat-barley, cultivated in Staffordſhire, ſhaped "like barley, but with a grain like wheat. It is "much ſown at Rowley, Hamſtal, and Redmore, "where they call it French barley. It makes "good bread and good malt, and yields a good "increaſe; and therefore would do well to be "tried in other places." It ripens early, does beſt in a dry ſoil, and is not apt to be much hurt by birds, from which it's beard and double huſk preſerve it.

Oats.

Mr. Miller[o] reckons four ſorts of oats cultivated in England; *viz.* the white, the black, the brown or red, and the naked oat, in which, though ſuppoſed to be only accidental varieties, he has never obſerved any alteration where they have been cultivated ſeparately for many years. Their principal difference is in the colour of their grain.

The white ſort, which is moſt common about London, makes the whiteſt meal, and is chiefly cultivated where the inhabitants live much upon oat-cakes. The black oat is more cultivated in the northern parts of England, and is eſteemed a very hearty food for horſes. Red oats are much cultivated in Derbyſhire, Staffordſhire, and Cheſhire, but are ſeldom ſeen in any of the counties near London; though, as they are a very hardy ſort, and yield a good increaſe, they will be well worth propagating, eſpecially in all ſtrong lands. The ſtraw of theſe oats is of a browniſh red colour, as is alſo the grain, which is very full and heavy, and eſteemed better food for horſes than either of the other ſorts. The naked oat is leaſt common

[n] *Vol.* I. *p.* 130. [o] *Gardener's Dictionary*, Art. AVENA.

in

in the ſouthern parts of England; but in the northern counties, in Scotland, and in Wales, it is pretty much cultivated, and is particularly eſteemed, becauſe it's grain threſhes clean out of the huſk, and need not be carried to the mill, to be made into oat-meal or griſt.

As oats are very hardy, and will thrive in almoſt any ſoil, they have been a great improvement to many eſtates in the northern parts of this kingdom, where, though ſown even ſo late as April, and in ſtiff ground, they have ripened early, and yielded a good crop. However, February, or March, according as the ſeaſon proves early or late, is a more common, and better, time for ſowing this corn, of which it will always be right to ſow the largeſt grained ſort, earlieſt.

Oats are often ſown after a crop of wheat, rye, or barley; in which practice the common method is to turn in the ſtubble, with one plowing, about the beginning of February, and ſow the ſeed with a broad-caſt, at twice, harrowing it in, once after the firſt ſowing, and five or ſix times after the ſecond; obſerving to draw the harrow once or twice acroſs the furrows, to break the clods and cover the ſeeds, but at the other times to harrow in the ſame direction as the furrows, leſt the ſtubble ſhould be raiſed on the ſurface. But it would be much better huſbandry to plow in the ſtubble in autumn, that it may rot in winter, and to give the land another plowing, and a good harrowing, juſt before the oats are ſown. This will render the ground finer and fitter to receive the grain, the increaſed produce of which will amply repay the extraordinary expence of tillage. M. Duhamel, after obſerving [p] that every farmer knows, though but few practice it, that all crops

[p] *Culture des Terres, Tom.* VI. *p.* 2.

of

of ſpring-corn are greatly bettered by this method, inſtances the example of M. d' Elu, one of his correſpondents, who having given three plowings to ſome of his oat-lands, had in 1759, a year remarkably dry and unfavourable to ſpring-corn, a plentiful crop of oats, which held up well till they were perfectly ripe, and yielded excellent grain.

Another thing, which I muſt alſo inſiſt on, is, that if farmers were to follow the directions before given [q] in regard to the changing of crops, by which means oats, which impoveriſh the ground, would always ſucceed ſome one of the meliorating crops, the return would be much more plentiful than in the common way, becauſe the earth would be in a much looſer ſtate.

When oats, as it frequently happens, are ſown upon a lay, or on ground newly broken up, after only one plowing, which is given in January, when the earth is moiſt, to turn down the ſward; the harrowing muſt be in the ſame direction as the furrows, or but very little a-croſs, for fear of raiſing the turf. But this again is bad huſbandry: for the ground would be brought to a much better tilth for other grain, as a preparation for which this ſowing is chiefly intended, by giving the ſward time to rot before the oats are ſown; becauſe the roots of the graſs will prevent thoſe of the corn from ſtriking downward.

Black oats delight in a moiſter ſoil than the white ſort, and, being a hardier plant, may be ſown a month earlier. The white, which prefer a dry land, and will do well on gravel and ſand, are the beſt of all corn for ground ſubject to quick-graſs or weeds, becauſe it may be plowed later for them, and they riſe ſooner, and top the weeds

[q] *Page*

better

better than black oats. The weather cannot be too dry when white oats are ſown[p]; though the ground may then be moiſter for them, than barley will endure; becauſe this laſt, having a thinner coat, is ſooner chilled by imbibing the wet, which may perhaps burſt many of it's veſſels; whereas white-oats, being protected by a double huſk, better reſiſt the entering of the moiſture. Mr. Liſle, who makes theſe remarks, adds[q], that, according to the beſt of his obſervations, white-oats require a rich feeding ſoil; becauſe their haulm, or ſtraw, running to a great largeneſs, cannot be ſupported without good juices and moiſture; that white chalky ground, though in never ſo good heart, will be unfruitful with white oats; and that a mixed mould, between white earth and red clay, of which there is a great deal in the hilly parts of Hampſhire, is not feeding enough for them. The red, and the white clays, when in good heart, carry moiſture enough, and are very fit for this grain.

The common allowance of ſeed oats is four buſhels to an acre: but Mr. Miller rightly thinks three buſhels more than enough: and the uſual produce is about twenty five buſhels from an acre; though he obſerves, that he has ſometimes known more than thirty buſhels reaped from that extent of ground; and I can ſay with truth, from an accurate account now in my poſſeſſion, that a gentleman, who is indeed an excellent huſbandman, has had, for a continuance, forty eight buſhels of oats from off each acre of his land ſown with that grain. I do not mean forty eight buſhels of naked oats; for the produce of that ſort is the leaſt of any in bulk, becauſe it's grains are ſmall, and lie very cloſe together: but they

[p] MORTIMER, *Vol.* I. *p.* 135. [q] *Vol.* I. 290.

make

make up in value, for what is wanting in meaſure. White oats always produce a greater increaſe than black oats. M. Liſle threſhed a ſtack of twenty eight loads of the former, and found it yield more grain than a ſtack of thirty eight loads of the latter; and farmers, in general, account an ordinary crop of white oats, as good as a middling crop of black oats[r]. This laſt ſort is alſo moſt liable to blight; eſpecially if a hot ſummer follow a dry cold ſpring, and the grain has been ſown on lay-ground [s]. Their culture is alike; and the manner of mowing and ordering them at harveſt, exactly the ſame. Only it is to be obſerved, that white oats are apt to ſhed moſt as they lie, and black oats as they ſtand [t].

In the year 1709, Mr. Liſle[u] ſowed, in the beginning of May, in ſome of his wheaten ground, where the corn had been killed by the preceding hard winter, rath-ripe barley in one part, and ſhort grained white oats, which he diſtinguiſhes by the name of white Poland oats, in another. Both grains were ſown on the ſame day, in an equally fertile, moiſt and well tilled ground. He made no doubt but that the Poland oat would be firſt ripe, and was therefore ſurpriſed to ſee the rath-ripe barley ſpring up ſooneſt by four or five days: but, reflecting on the nature of each grain, he ſoon concluded the reaſon to be, that the oat, having a double hull, and being conſequently better guarded from moiſture, could not imbibe the vegetable water ſo ſoon as the barley; but that, the texture of the flour of the oat, and the infolded fibres of the incloſed plant, being ſofter, it would conſequently grow faſter. — From hence he infers that, to ſecure the growing of Poland

r *Ibid. p.* 291 s *Ibid. p.* 292. t MORTIMER, *Vol.* I. *p.* 135. u *Vol.* I. *p.* 292.

oats

oats without rain, they muſt be committed to the earth before it becomes ſo dry as is proper for the ſowing of barley; not only becauſe the oats require more moiſture to make them grow, but alſo becauſe they lie ſo many days longer in the ground, before they come up, than the barley does.

When oats are about four inches high, intelligent huſbandmen run a wooden roller over them, after a ſhower of rain has ſoftened the clods; by the breaking of which in this manner, freſh earth is laid to the roots of the plants, their tillering is conſiderably increaſed, if they have not been ſown too thick, and the ſurface of the field is ſmoothed; ſo that the mowers, at harveſt, are able to cut cloſe to the ground, as it is very fit they ſhould, becauſe oats ſeldom grow high. Both oats and barley ſhould be carefully weeded.

Oats are ripe when the ſtraw turns yellow, the grain becomes hard, and the chaff begins to open and ſhew the ſeed. When mowed, they are generally let lie ſome time for the dew and rain to plump them, and make them threſh well, and, if weedy, to kill the weeds: but if rain wet them much, they ſhould be carried off as ſoon as they can be got tolerably dry again, or they will ſhed; for oats may be inned the wetteſt of any corn, if the weeds among them be but dead. Even in very rainy harveſts, when other grain is ſpoiled, this will receive little or no damage, the ſurface of it's ſtraw and ears being ſo ſmooth and compact as to turn off water; and of ſo dry a nature, that, though houſed wet, they will not heat in the mow, or become mouldy, as other grains uſually do. This is a vaſt advantage in northern climates, where the harveſt is generally late, and the autumn wet.

M. Du-

M. Duhamel is ſtrongly of opinion that farmers, eſpecially thoſe who keep many cattle, would find their account in houſing their oats directly, without letting them lie out after they are cut, as is the common way, that rain and dews may moiſten, and conſequently ſwell their grain. He earneſtly adviſes huſbandmen to try the experiment upon a part of their crop; "becauſe", ſays he [x], "the fodder will, by this means, certainly be much better for cattle, and much leſs grain will be loſt in the field. It may be objected, that theſe oats will be difficult to threſh: to which I anſwer, that if this be the only inconvenience, the ſuperior quality of the fodder, and the ſaving of a quantity of grain which would otherwiſe be ſhed, will probably more than pay the extraordinary wages of the threſher.

"But allowing that the oats thus houſed cannot be threſhed quite clean, and that ſome grain will neceſſarily remain in the ears, I ſay, that this will not be loſt to the farmer; for he is obliged to give his cattle un-threſhed oats, and they will eaſily find the grains remaining in the ſtraw, which will not perhaps exceed the quantity that would have been droped in the field: and even granting, though it will not happen, that the greateſt part of the grain be left in the ear, ſtill it will not be loſt in the hands of an intelligent farmer; for what ſhould hinder him from giving it to his horſes? ſuppoſing that four ſheaves yield a buſhel of oats, he need only give his horſes thoſe ſheaves inſtead of a buſhel of corn. They will certainly be longer in feeding upon four ſheaves, than upon a buſhel of cleared oats; and at the ſame time they will eat ſome ſtraw with the corn, which will

[x] *Traité de la Culture des Terres, Tom.* VI. *p.* 455.

"ſupply

" ſupply the place of other fodder, and probably " prove a more healthy food." This method may be particularly beneficial to ſuch as live in very hot countries, or in very dry ſeaſons.

Mr. Liſle, refuting the opinion of thoſe who think that oats cut green will ripen while they lie in ſwarth, ſays [y], " If by ripening be meant ſhrink-" ing, drying, or withering, I muſt allow the po-" ſition; but if the country-man will have it that " the greeniſh oat, cut a fortnight or ten days, or " be it but a week, before it is ripe, will proceed " in it's vegetable increaſe, and ſwell as well as " harden by lying in ſwarth, I muſt deny it. — " This year (1707) I made a full experiment of " this matter; for when the ſpring corn was ſown, " the ground being generally dry, half the oats " and barley came not up till the latter end of " May, when rain came, whereby in moſt places " half the crop was edge-grown. The forward " oats being then in danger of ſhedding, we were " forced to cut down the greeniſh corn with the " ripe, when otherwiſe we ſhould have waited ten " days longer. I let them lie in ſwarth above a " week, and, when I carted them, I found the " hull of the greeniſh oat had got a riper colour, " and the pith was well hardened, but pitifully " lean and ſhrunk: ſo that, though this is to be " done on neceſſity, yet it ought not to be prac-" tiſed with ſuch indifference as is uſual among " farmers. — Note, the pith of theſe green oats " was well paſt the milk, and come to a floury " ſubſtance."

The ſame gentleman adds, that oats are the worſt of all grain to keep, becauſe of the great moiſture in them, and their conſequent aptneſs

[y] *Vol.* I. *p.* 294.

to

to heat when laid in a heap; and that when the heat has been ſuch as to ſpoil them for growing, their hulls look as red as a fox.

The meal of oats makes tolerably good bread, and is the common food of the country people in the north. In ſome places, beer is made with this grain: in Ruſſia, in particular, the poorer ſort make with it a drink which they call *Quas*; but it's principal uſe is for the food of horſes, for which purpoſe it is reckoned very wholſome, being ſweet, and of an opening nature: but it muſt not be given them before it has ſweated in the mow, or been otherwiſe dried, leſt it ſhould prove too laxative.

The very long drought of the ſummer of this year, 1762, has been the means of ſhewing another very profitable uſe of oats, on ſuch occaſions; and probably it will anſwer equally well in the winter. Some milk-men near London boiled oat-meal in the water which they gave their cows to drink, and found that the expence was abundantly repaid by the additional quantity of milk which thoſe cows yielded more than thoſe which had not this maſh.

Barley.

Mr. Miller diſtinguiſhes[a] four ſpecies of barley, *viz.* 1, Spring barley with many rows of grain; 2, the common long-eared barley; 3, barley with ſhorter and broader ſpikes, commonly called ſprat-barley; and, 4, winter or ſquare barley, which is alſo called bear-barley, or big.

The firſt of theſe, which is the common ſpring barley moſt generally cultivated in England, is again divided into two ſorts, *viz.* the common, and the rath-ripe barley, which laſt our author

[a] *Gardener's Dict.* Art. HORDEUM.

takes to be only an alteration in the former, occaſioned by it's having been long cultivated upon light gravelly ground: and in fact, the ſeeds of this early ſort will, when taken from ſuch a ſoil, and ſown in ſtrong ſtiff land, ripen near a fortnight ſooner than others of the ſame kind taken from ſtrong land. For this reaſon, the farmers in the vales generally purchaſe their ſeed barley from the light gravelly up-lands; but after two or three years of culture in the vales, it becomes full as late in ripening as the common barley of the uſual growth of the place: and on the other hand, the farmers in the up-lands procure their barley from the ſtiff grounds in the vales; for without this change, their grain would degenerate in fulneſs and bulk. This ſort of barley is eaſily diſtinguiſhed by it's double row of beards, or awns, which ſtand erect, and by the thinneſs of it's chaff.

The common long-eared barley, which is Mr. Miller's ſecond ſort, is an excellent grain, and much cultivated in many parts of England; though ſome farmers object to it, becauſe, ſay they, the length and weight of it's ears render it the moſt liable to be lodged. The grains of this ſort, regularly ranged in a double row, lie over each other, like tiles on a houſe, or the ſcales of a fiſh, and are without awns.

The ſprat barley, likewiſe called Fulham barley, from the great quantities of it cultivated about that place, and likewiſe Patney barley, from Patney in Wiltſhire, where much of it grows [b], has ſhorter and broader ears, longer awns, which help greatly to preſerve it from birds, and cloſer ſet grains than either of the other ſorts, which it ſeldom equals in height; nor is it's ſtraw, being

[b] MORTIMER, *Vol.* I. *p.* 130.

coarſe

coarſe as well as ſhort, accounted ſo good fodder for cattle.

The bear-barley, or big, is ſeldom cultivated in the ſouthern parts of England, but very much in the northern counties, and in Scotland, becauſe it is by far the hardieſt of this ſpecies of corn, and beſt bears the cold. There are two ſorts of it; the one with four rows of grains, commonly called four-rowed barley, and the other with ſix, which laſt is frequently diſtinguiſhed by the appellation of barley-big. The rind of this is thicker than that of either of the other ſorts; for which reaſon our maltſters hold it leaſt in eſteem.

Both the four rowed and the ſix rowed barley are generally ſown in the autumn, nearly at the ſame time as wheat, not only in temperate climates, but alſo in very cold countries; their hardineſs being ſuch as to bear the winter's froſts, even in the mountainous parts of northern regions. In hot countries, they are ſown in January, February, and March.

Though barley, like every other grain, would be ſureſt to thrive in a rich and well tilled ſoil, which laſt circumſtance huſbandmen in general do not ſeem ſufficiently to attend to; yet it is found to do very well in light and ſandy, as well as in poor ſtiff lands, which would not be able to nouriſh wheat: but it delights particularly in a light dry ground, ſuch as is the black rich mould, and in moſt ſorts of clays that lie dry, eſpecially if theſe laſt have been well manured with dung, aſhes, chalk, or lime. Sir Hugh Plat commends ſoap-aſhes as an extraordinary improver of this grain even upon barren lands; and it has been experienced that pigeons dung, malt duſt, and ſoot, are remarkably efficacious here [c].

[c] MORTIMER. *Vol.* I. *p.* 113. and *Maiſons ruſtiques, Tom.* I. *p.* 667.

The common time of ſowing barley in this country, is, if the weather be dry, (for that is neceſſary when this grain is ſowed, though the contrary is more proper for wheat), early in March for very dry light land; but in ſtrong clayey ſoils, it is not ſown till April, and ſometimes not until the beginning, nay, even the end, of May, which is certainly too late; becauſe, if the ſeaſon does not prove extremely favourable, the autumn muſt be far advanced before the crop can be fit to mow, unleſs, perhaps, it be of the rath-ripe ſort, which frequently ripens in nine weeks, from the time of ſowing: though Mr. Liſle is of opinion [d], that this, in particular, ought to be ſown early, for that otherwiſe it will grow very thin. He likewiſe thinks that it ſhould be ſown on better ground than other barley, becauſe, as it ripens in a ſhorter time, it may be ſuppoſed to exhauſt the nutritive juices of the earth faſter than other corn. In anſwer to which laſt argument, it is ſaid, that theſe nutritive juices, in almoſt any tolerable ſoil, will probably hold out long enough to feed a crop of ſuch ſhort ſtanding as this is, though they might not ſuffice for corn which ſhould remain longer upon the ground; and that near Patney, in Wiltſhire, where a great deal of this grain is raiſed, it is ſown on the pooreſt ſandy ground, and thrives perfectly well. What ſeems to be leſs diſputed, is, that this ſpecies of corn ſhould be ſowed in a ſtrong ſoil; becauſe it's ſtraw being very hollow, and conſequently weak, it will be liable to be eaſily beaten down and lodged.

Mr. Liſle himſelf, in the year 1707, ſowed, in Hampſhire, rath-ripe barley in very poor white ground, and ſome of the ſame ſort of grain in very good ſtrong clay land [e]. No rain fell, to

[d] *Vol.* I. *p.* 271. *and* 278. [e] *Ibid. p.* 272.

bring

bring it up, till June; after which there were frequent ſhowers, and plenty of rain till harveſt. His rath-ripe barley in the poor light land was miſerably bent, broken in the ſtraw, beaten down, and intangled. The ſame ſort of corn in the ſtrong clay-land ſuffered the ſame injuries, though not in ſo great a degree: but the ſtraw and leaves of the plants of the rath-ripe barley in both places were blighted and full of black ſpecks, their ears were thin, and their colour was loſt; whilſt the plants of late ripe barley in an adjacent field, were free from theſe ſpots, and ſtood upright with good ſtrength. He infers from hence, and it would ſeem juſtly, that ſince the clay-land in the hilly country of Hampſhire, though in good heart, and in a moiſt year, cannot ſufficiently feed the ſtraw of the rath-ripe barley, ſo as to enable it to ſtand upright, but ſuffers it to be languid and withering, this ſort of corn is not proper for ſuch places, and that it is better there to ſow late-ripe barley, even though three or four horſes extraordinary be provided againſt ſowing time, in order to get the ſeed into the ground a week before the beginning of May.

Another important obſervation which Mr. Liſle made on the ſame occaſion, concerning the accidents to which rath-ripe barley is ſubject in ſuch dry ſprings, was, that one half of the ſeed, which fell deep, came up without rain, but the reſt did not ſprout till rain came. The half which came up firſt, could not, by reaſon of the weakneſs of the ſtems, wait for the ripening of the latter edge-grown corn in the ſame field; but it's ſtraw bent, broke, and was intangled, and the ears buried themſelves among the broad-clover ſown with the barley, ſo that he was forced to cut it; not being able to ſtay a week or ten days longer for the edge-grown corn to ripen: whereas, the late ripe

barley ſtood ſo upright in it's ſtraw, that the corn which came up firſt would ſtay ten days for the edge-grown corn.

The ſame gentleman had another manifeſt proof, in the year 1706, that the ſtraw of the early-ripe barley is thinner and weaker than that of the late-ripe. All his rath-ripe barley (of which he ſowed fifty acres in different ſorts of ground, and ſome of it ſide by ſide with late-ripe barley,) crumpled down in the ſtraw, while the late-ripe barley of the ſame forwardneſs and growth ſtood upright.

Upon the whole, Mr. Liſle, after obſerving farther, that, if the ground be good, and the year a feeding one, rath-ripe barley is apt to run rank, and to fall whilſt very green in ear, which occaſions the grain not to fill; concludes, in regard to this ſort of corn, that it ſhould always be ſown early, that the expoſition of the ground ſhould not be to the north, and that the ſoil in which it is planted ſhould be pretty good, either naturally ſuch, or rendered ſo by art; "for we "know", ſays he, "that the poorer the ground is, "the weaker and poorer the ſtraw will be in all "ſorts of corn; and if the rath-ripe barley has by "nature a weaker and thinner ſtraw than the "late-ripe barley, and on that account is apter "to crumple, to bend down, and to break in the "ſtraw before it is ripe; much more will it be "apt to do ſo, when the ſtraw is made much "thinner and weaker than naturally it would be, "by the poverty of the ground it is ſown in. It "is very evident to me, that rath-ripe barley "ought not to be ſown on poor ground, and "much leſs ſo, in caſe it lie declivous from the "ſun towards the north."

The middle-ripe barley, as Mr. Liſle terms it, meaning the ſame ſpecies as the rath-ripe when not accelerated in it's growth by the method

of culture before mentioned, or in other words, the common ſpring barley, bears late ſowing, even on ground declivous from the ſun, better than the rath-ripe ſort; but not near ſo well as the late-ripe, or common long-eared barley; nor will it's ſtalk ſtand ſo long. Mr. Liſle's experiments ſhewed him, that late-ripe barley will endure being ſowed when the ground is wetter than will do for the rath-ripe ſort [f], and that a bottom ground, or vale pent in between two hills, though ſhaded by one from the ſun, will, by means of the warmth and cloſeneſs of the air, often ripen corn as faſt as a ground lying declivous to the ſun. In a field which he ſowed with middle-ripe barley (the common ſpring barley), the loweſt part, lying on a flat, ripened regularly, and even ſooner than another part of the ſame field which lay upon the ſide of a hill declivous to the ſun: but on that ſide of the ſame hill which ſloped from the ſun, the corn was more edge-grown, lay backward, and neither looked ſo white, nor was ſo ripe [g].

The land which lies both very dry and healthy, and in which mellowneſs and lightneſs are joined to ſtrength of ſoil, is that which produces the beſt bodied and thinneſt rinded barley; qualities which always recommend this grain, particularly to malſters. Such generally is the barley of the growth of hilly countries. But poverty of ſoil is by no means requiſite in land, in order to it's carrying a plump and thin rinded barley: though it is allowed that poor land which lies dry and warm, will bear better corn of this kind, than rich land in a wet and cold ſituation: for barley does not ſtand ſo much in need of ſtrength in the land, as of the healthineſs and warmneſs of the ſoil; though both are beſt, where they can be had [h].

[f] *Vol.* I. *p.* 278. [g] *Ibid. p.* 275. [h] *Ibid. p.* 281.

To the general directions before given for the choice of ſeed-corn, I ſhall only add here, with reſpect to barley, that the beſt grain for ſowing is that which is not blackiſh at the tail nor has a deep redneſs, but is of a pale lively yellow colour, intermixed with a bright whitiſhneſs; and if the rind be a little ſhrivelled, it will be ſo much the better: for that ſlight ſhrivelling, occaſioned by it's having ſweated in the mow, is a ſure indication that it's coat is thin. The huſk of thick rinded barley, being too ſtiff to ſhrink, will lie ſmooth and hollow, even when the inſide flour has ſhrunk from it.

The neceſſity of a change of ſeed, from time to time, by ſowing that of the growth of a different ſoil, is no where more evident than in the culture of this grain, which otherwiſe becomes coarſer and coarſer every year. It is well known that the ſeed of the common barley ſown once in the burning ſand at Patney in Wiltſhire, will retain the faculty of ripening ſooner than any other ſort, for ſome years, if it continue to be ſown in ſuch ground; and that it will intirely loſe this quality, in two or three years, when ſown in cold clayey land. But at all times, in this, and in every other grain, it behoves the huſbandman to take care that his ſeed be full bodied.

To be ſatisfied in this, Mr. Liſle[i] took out of a heap of barley ſixty grains, of different ſizes, *viz.* twenty of the biggeſt, twenty of the middle ſize, and twenty of the ſmalleſt corns. He planted the twenty of each ſort in three ſeveral pots, with rich mould of the ſame ſort in each pot. In eight or nine days time, thirteen of the fulleſt bodied grains were come up, nine of the middle ſized, and only five of the ſmalleſt; and the

[i] *Vol.* I. *p.* 283.

plants

plants of the plumpeſt corn exceeded thoſe of the others both in colour and breadth of blade. In three days after, he found nineteen blades of the largeſt ſort come up, ſeventeen of the middle ſize, and thirteen of the ſmalleſt; and in three days more, the blades of the beſt and the middle ſort were all come up, whilſt only ſeventeen of the worſt had ſprouted, with ſuch manifeſt diſadvantage in colour and ſtrength in theſe laſt, as plainly ſhewed that many of them would not have come up at all in poor ground.

Barley muſt certainly be benefited, as wheat is well known to be, by being ſteeped before it is ſown: and ſurely there is the greater reaſon for extending this practice to every kind of ſpring-corn, as rain cannot be depended on ſoon after the ſowing of theſe, ſo much as after the autumnal ſowings. For this reaſon in particular, the later ſpring-corn is ſown, the more neceſſary it is to ſteep it. Huſbandmen who do not lime their barley, for fear, perhaps, of it's being hurt by the coming on of hot weather, will at leaſt do well to try the effect of ſprinkling it with ſoot, which, if it do no other good, will probably prevent it's being preyed upon by inſects: and I would likewiſe recommend to their attention, in the ſowing of this or any other grain, a fact which the Rev. Dr. Eliot relates [k] of a farmer, who, being obliged to attend other buſineſs in the courſe of the morning, ſowed oats at break of day, and harrowed them in before ſun-riſing. The corn thus early ſowed out-ſtript the other oats ſowed on the ſame day after the ſun was up, had larger ears, and appeared every way better, though the ſpot in which it grew was the worſt part of the field. It is agreeable to reaſon that dew ſhould have

k *Eſſays upon Field Huſbandry*, p. 29.

this

this effect when buried with the corn; and it may be well worth the farmer's while to try, I will ſuppoſe firſt upon a ſmall quantity, whether his ſeed will not be conſiderably benefited by being ſowed in the evening, left all night to be ſoaked and ſoftened with the dew, and then harrowed in the morning.

Barley is moſt commonly ſown either after a fallow, or on an etch or ſecond crop. If after a fallow, the land muſt be plowed at leaſt three times; and at the firſt plowing it ſhould be laid up in ſmall ridges, ſo to remain all the winter, for the froſt to mellow it: but if another plowing can be given in January, or in the beginning of February, the ground will be ſtill much better broken and prepared. In March, theſe ridges are ſplit, the ground is well harrowed and laid as ſmooth as can be, and if poſſible, it is plowed again the ſame day, in order to ſow. But in ſtrong wet lands, the beſt way is to lay it round, and make deep furrows to receive the water.

Some, at the time of twy-fallowing in June, make the land very fine and ſow it with turnips, which they feed with ſheep in the winter; and in March, they plow it up and order it as before: but others, who take this method of ſowing turnips, give it but one plowing in March, juſt before they ſow.

Thoſe who ſow barley upon an etch after wheat, plow up the wheat-ſtubble in as dry weather as they can, as ſoon as the time of ſowing wheat is over, which is generally about the beginning of October, and lay three ridges into one, if they have dung to ſpread upon it: but if they have not, they plow it in ſmall ridges as before directed, that it may lie the drier, and be the better mellowed by froſt: they then plough it up again in March, and order it as before. Some farmers, injudiciouſly,

judiciouſly, ſow their barley after oats, in which caſe neither of theſe three plowings ought by any means to be neglected; and the land will be in much better order if the firſt of them is given in October: or, if the harveſt be early, the weather dry, and the huſbandman can poſſibly find time to do it, he will improve his ground ſtill more, by plowing it up before he ſows his wheat, juſt as harveſt is in: this will be half as good as a ſummer's fallow. But all years will not admit of this practice: and I muſt here again repeat what I ſaid before in the direction for ſowing oats, and alſo in the change of crops, that every kind of grain ſhould be ſowed either after a fallow, or a meliorating crop. Some ſow their barley on ſmall ridges, and others on broad lands, which laſt cannot be laid too round.

Mr. Mortimer relates[1], that a farmer in Eſſex who lived near a market town, from whence he had good quantities of dung, uſed to ſow his land with barley and clover, reaped the corn at harveſt, fed the clover all the winter, and from ſpring till the middle of July, when he fallowed his ground. In the next ſpring, he ſowed it again with barley and clover, and repeated every year this method, by which he had large crops. His land was a rich light mould, ſomewhat inclining to a gravelly bottom.

I have already obſerved, that the uſual time of ſowing barley is in March, April, or the beginning of May. It is generally thought moſt adviſable to ſow light lands the earlieſt, and to take for ſo doing the firſt dry ſeaſon that offers; dry weather being beſt for moſt ſummer corn. Clayey ground, and land ſubject to weeds, are thought to produce the beſt crops when ſowed late. Mr.

[1] *Vol.* I. *p.* 132.

Mortimer

Mortimer ſays [m] that barley will do well when ſowed even about the middle of May, if the ſeed has been properly ſteeped.

Barley is moſt commonly ſowed in broad-caſt, upon land laid in wide ridges: but conſidering the danger of drought at the ſeaſon in which it is ſowed, an infinitely better way would certainly be to ſow it either under furrow, or with the drill.

Four buſhels of ſeed are the uſual allowance for an acre of ground: but I am clearly of opinion that three buſhels are very ſufficient, or even leſs if graſs or clover ſeed be ſown with the corn; of which practice, farther notice will be taken hereafter. Mr. Miller thinks [n], that even leſs than two buſhels to an acre will produce the moſt plentiful crop, and the fineſt and healthieſt plants. The common produce is from two to three quarters upon an acre.

If dung of pigeons, poultry, or any other kind, be ſcattered over barley, or wheat, after the grain is ſown, as is frequently done, it ſhould be ſtrewed immediately; becauſe then the ſhoot will eaſily make it's way through: but when laid on later, it burns up and rots the blades of the young plants. When the barley is ſown, the ground ſhould be rolled after the firſt ſhower of rain, to break the clods, and lay the earth ſmooth, that it may be the better mowed when ripe; and alſo to make the mould lie the cloſer to the roots of the corn, which will be of great ſervice to it in dry weather. About a month or ſix weeks after the barley is up, it ſhould be rolled with a pretty heavy roller, which will again preſs the earth cloſe to the roots of the plants, and preſerve them from being hurt by the ſun or drying winds, particularly in dry ſeaſons; and will greatly contribute to

[m] *Ibid.* [n] *Gardener's Dict.* Art. HORDEUM.

ſtrengthen

ſtrengthen their ſtalks, and make them tiller. A few ſhowers before harveſt, will help to make the rind of the grain fine and thin. If the corn grows too rank, as it is ſometimes thought to do in a wet ſpring, mowing is then much better than feeding it; becauſe the ſcythe takes off only the rank tops, but the ſheep feed upon all indifferently: nor ſhould they, in any caſe, ever be left upon it too long, becauſe, being particularly fond of the ſweet end of the ſtalk next the root, they will bite ſo cloſe as to injure the future growth of the plant.

Barley is ripe when the red roan, as farmers call it, meaning a reddiſh colour, is gone from off the ear, when it bends down it's head, and when the ſtraw has loſt it's verdure. It ſhould not be cut till then: for though the grain of ſome ears which ſtand upright may ſeem to be full hard and dry; yet their ſtraw, if carefully examined, eſpecially at the knots, will ſtill be found to be greeniſh, and will therefore be apt to heat in the mow, which will render the grain abſolutely unfit for malting, or indeed for almoſt any other uſe; for it then becomes ſo very bitter, that even hogs will hardly eat it. If it be full of weeds, it muſt lie in ſwarth till they are dry; which may be the more eaſily done, as this corn is not apt to ſhed: but, on the other hand, it will incline to ſprout, or grow muſty, in wet weather; for which reaſon it ſhould be ſhook up and turned every fair day, after rain; and as ſoon as it is grown dry, it may be made up into cocks; though it muſt not be houſed whilſt any moiſture remains in it.

Mr. Liſle ſays[o] that poor thin barley, and oats, ſhould be cut a little ſooner than if the ſame plants were ſtrong and vigorous; for that the

[o] *Vol.* I. *p.* 335.

ſtraw,

ſtraw, when they are full ripe, will not ſtand againſt the ſcythe. In this caſe, the barley, in particular, muſt lie in ſwarth till it is thorougly dry. Some of his, which lay out in ſwarth five or ſix days, in very fine weather, though both blighted and edge-grown, grew plump, and acquired very near as good a colour as the beſt[p]. He reckons ſhort ſcythes the beſt for mowing lodged or crumpled corn, becauſe they miſs the feweſt plants; and obſerves, that a bow upon the ſcythe, which will carry the ſwarth away before it all together, is preferable to a cradle, the fingers of which would be pulled to pieces by the intangled corn, in drawing back the ſcythe.

One perſon is accounted ſufficient to rake oats after the cart, unleſs in a very high wind; but to rake after the barley-cart, be the wind never ſo ſtill, two perſons are always reckoned neceſſary: and it is likewiſe thought to be good huſbandry, becauſe it ſaves much time, to have two pitchers to one loader in the field, when the ſtraw of the barley runs very ſhort.

The huſbandman ſhould be very attentive to the proper culture of this grain; for it is that from which is made the moſt ſocial cup of any thing that this country affords, and perhaps as wholſome as is produced in any other. The common *ſpring*, and the common *long-eared* barley are the ſorts moſt generally eſteemed here for malting, becauſe their rind is thinneſt. The ſquare-eared barley, diſtinguiſhed by the name of *big*, is very little uſed, or valued, by our maltſters, on account of the thickneſs of it's hull: but the Scotch, upon experience, think it equal to any other kind, for malting, and in Flanders, where a great deal of beer is drank, they chiefly uſe malt made of

[p] *Ibid. p.* 336.

this

this ſort of grain [p]. But the merit of this queſtion will be farther diſcuſſed when we come to treat of *Brewing*.

In many countries, when their wheat falls ſhort, they make of barley, either alone, or mixed with wheat, bread which is cooling, pretty nouriſhing, but un-ſavoury, and hard to digeſt.

Barley has alſo it's medicinal virtues. We ſend a great deal of it to Holland, and, after it is made into *pearl*-barley, or *french*-barley, as it is commonly termed, for both are of the ſame kind, though differing ſomewhat in whiteneſs and ſize of the grain, *wiſely* re-import our own original growth, loaded with an extraordinary charge, which might eaſily be ſaved by manufacturing it at home.

In Spain, where little beer is drank, they feed their horſes with barley: we often give it to poultry; and Mr. Mortimer [q] reckons it one of the beſt grains for the fatting of ſwine, either when boiled till it be ready to burſt, with no more water than it drinks up, or ground in a mill, and made into a maſh. In either way it produces excellent bacon.

Maize, or *Indian Corn*.

Maize is ſo generally uſed for food in America, that it has obtained the name of *Indian Corn*. The ſize of it's ear differs greatly, according to the fertility of the ſoil, and the warmth of the climate in which it is cultivated; but, at a medium, it is about a ſpan long, and commonly has eight, or more, rows of grain, each of which uſually contains upwards of thirty ſeeds, of various colours, as red, white, yellow, blue, olive, greeniſh, blackiſh, ſpeckled, ſtriped, &c. ſome-

[p] *Maiſons ruſtiques, Tom.* I. *p.* 627. [q] *Vol.* I. *p.* 331.

times

times in the ſame field, and the ſame ear: but the white and yellow are the moſt common: nor does this diverſity of colours ever reach beyond the outſide of the grain, the flour of which always is white, with a little tinge of yellow. Theſe ſeeds, which are as big as large peas, are round at their outer ſurface, very ſmoth, and ſet extremely cloſe, in ſtrait lines. The ear is cloathed and armed with ſeveral ſtrong thick huſks, which defend it not only from unſeaſonable rains and the cold of the night, (for it does not ripen fully in ſome places till towards the latter end of September), but alſo from crows and other birds, which, being allured by the ſweetneſs of the grain before it hardens, flock to it in great numbers, peck through the top of the outer covering, and devour as far as they can reach. In the northern colonies, the ſtalk of this plant, which contains a remarkably ſweet pith, and is jointed like a cane, does not grow near ſo high as in the ſouthern parts. It has long leaves, almoſt like flags, at every joint, and at the top a bunch of flowers, of various colours, highly pleaſing to the eye. The northern Indians, far up in the country, have a ſpecies of this grain, (called Mohawk's corn) which never grows high, and, though planted in June, ripens in due ſeaſon. The general time of planting it is betweeen the the middle of March and the beginning of June, or, more particularly, from the middle of April to the middle of May.

Mr. Ray was of opinion [r] that there are two really diſtinct ſpecies of this plant; but Mr. Miller is certain [s] that there are three, which do not alter by culture, and which he characteriſes thus.

[r] *Philoſoph. Tranſ. No.* 205.
[s] *Gardener's Dict.* Art. ZEA.

"The

"The firſt of theſe, with yellow grains, grows naturally in the iſlands of the Weſt Indies, and has a very large ſtrong ſtalk, which riſes to the height of ten or twelve feet. It's leaves have a broad white mid-rib, are long, broad, and hang downward. The male flowers (for maize has both male and female flowers, ſituated at remote diſtances on the ſame plants,) come out in branching ſpikes at the upper part of the ſtalks, and are from eight to ten inches long. The female flowers come out from the bottom of the leaves on the ſide of the ſtalk, and are diſpoſed in a cloſe, long, thick ſpike, which is covered cloſely with their leaves: out of the end of this cover hangs a thin long bunch of filaments or threads, which are ſuppoſed to convey the *farina fœcundans* of the male flowers to the germe of the female. When the ſeeds of this ſort are ripe, the ſpikes or ears are nine or ten inches long, and ſometimes a foot: but theſe rarely ripen in England.

"The ſecond ſort, which has white grains, is cultivated in Italy, Spain, and Portugal. The ſtalks of this ſpecies are ſlenderer than thoſe of the former, and ſeldom riſe more than ſix or ſeven feet high. It's leaves are likewiſe narrower, are hollowed like the keel of a boat, and their tops hang downward. The ſpikes of the male flowers of this, are ſhorter than thoſe of the former ſort, and the ears, or ſpikes of grain are ſlenderer, and not more than ſix or ſeven inches long. The grains of this ſort do not come to maturity in England, unleſs the ſeaſon proves very warm, and they are planted early in a warm ſoil and ſituation.

"The third ſpecies, which has a yellow and white ſpike, is cultivated in the northern parts of America, and alſo in Germany. The ſtalks of this are ſlender, and ſeldom riſe more than four

feet high. It's leaves are ſhorter and narrower than thoſe of the two former, are hollowed like the keel of a boat, and their tops hang down. The ſpikes of the male flowers of this ſort are ſhorter than thoſe of the others, and the ears, or ſpikes of grain, are ſeldom more than four or five inches long. This ſort ripens perfectly well in England, in as little time as barley, and therefore may be cultivated here to advantage."

This plant is ſeldom cultivated in England for uſe, though it might probably turn to good account, as was lately experienced by a gentleman in Lincolnſhire, who planted this corn in an open field, where it ripened perfectly, and yielded an abundant crop; but very great quantities of it are raiſed in Aſia and Africa, in ſeveral parts of France, in Italy, Germany, and North America, of it's culture in which laſt place the author of this work has been favoured with the following account, by a very worthy and ingenious gentleman of that country, who ſpeaks from his own knowledge.

"The Engliſh in North America plow the "ground thoroughly before the grain is planted. "They ſeldom, if ever, dung the whole face of "the field, but ſometimes put a little dung in "each hill of corn, if they think the ground "requires it. Where fiſh are plenty, in the plant-"ing ſeaſon, they put two or three ſmall fiſh into "each hill, with the grain.

"In order to plant the corn, they make trenches "or furrows, with a plough, acroſs the field, at "certain diſtances from each other, and croſs "theſe with others of the ſame diſtance, which "divide the field into ſquares; and where the "trenches interſect, the grain is put in, and "covered. Three or four grains are commonly "planted for each hill. The intermediate ground

"is

" is afterwards plowed at leiſure, as the plants " grow, and want more looſe earth for the roots " to ſpread in. The hills are made at the time of " weeding; ſome looſe earth being then hoed up " over the roots, and round the ſtems or ſtalks of " the corn.

" The corn is planted at different diſtances in " different places. In the northern colonies, the " Indian corn grows low; ſeldom exceeding four " or five feet in height; and the leaves being pro- " portionably ſmall, the plants do not require ſo " much ground as in the ſouthern colonies, where " they frequently riſe to fourteen or fifteen feet. " The ſpace generally allowed for the loweſt " plants, is three feet, and for the higheſt, five or " ſix. This diſtance may be more neceſſary in our " manner of cultivating this corn; more ground " being required to nouriſh three or four plants, " than one; for I do not know that we ever pluck " up any of the plants. An advantage attending " this method is, that the labour is leſs in hilling; " three or four plants being earthed up in the " ſame time as one: and there is more room for " paſſing between the rows when the corn is to " be weeded.

" At the ſame time that the corn is weeded, the " ground is looſened round the plants, with a hoe, " and the hills are raiſed and enlarged from time " to time, by adding more earth. The morning, " before the dew is off, and the evening, are " reckoned better for this work, than the middle " of the day.

" The hilling of the corn, as it grows, has been " the univerſal practice: the deſign being to give " the plant more nouriſhment, and to ſupport it " better againſt the winds: but of late, ſome " planters have thought it better to plant in holes: " the reaſon is, that this plant requires a good

"deal of moiſture; and indeed, nature, by the "form and poſition of the leaf, appears to have "intended the receiving of the rain that falls "around, and conducting it to the ſtalk, and by "that, down to the roots: but a hill round the "ſtalk, tends to throw the water off to a greater "diſtance: and as to ſupporting the plants, they "ſay the hills do not effect it; becauſe, by cover-"ing the ſtalks, in that part, from the air and "ſun, which would harden and ſtrengthen them, "the mould around them keeps them ſoft and "tender, and thereby rather weakens them.

"The panicles, or toſſils, contain the *farina* "*fœcundans* of the plant, and therefore ſhould "not be cut off, till the grain in the ear is filled. "If the toſſils of a whole field ſhould be cut off "before that time, there would be no grain at "all in the ears. This has been proved by ex-"periment.

"In the more ſouthern colonies, where hay is "ſcarce, and the leaves of this corn are very "large, they cut them off for fodder: but in the "northern colonies, where there is plenty of hay, "and the leaves of the corn are ſmall, they gene-"rally neglect cutting off the toſſils, and ſtripping "off the leaves. They are left on the ſtalks, and "the cattle, being turned into the fields, after the "corn is gathered in, eat what they like of them: "but they are not eſteemed ſo good as what has "been cut in ſeaſon.

"An eaſy way of taking the grain out of the "ears, is, to rub one againſt another, holding "one in each hand.

"When the ears are ſtript of their huſks, they "are reckoned in the beſt ſtate for preſervation; "much better than when the grain is rubbed off "from the ear: for then, they ſay, inſects can

get

" get at the ſoft part of the grain; and eat into " it; which they cannot do, while the ſoft part is " connected with the cob in the ear, and the hard " flinty part of every grain turned outward, and " the grains cloſe to each other.

" To preſerve this corn, they make, in North " America, a ſort of bins, or cages, which they " call corn-cribs, fifteen or ſixteen feet long, and " five or ſix feet wide, widening upwards to the " top a foot or more. They are made of ſapling " poles, three or four inches diameter, framed " roughly together, by notching the ends where " they croſs the corners, at ſuch a diſtance from " each other, as but juſt to keep the ears from " falling through, that there may be a free paſſage " for the air. Theſe bins ſtand abroad, and have " a ſlight moveable covering, or thatch, to keep " out the rain. The Indians bury their corn in " holes in the ground, lined with mats and dry " leaves.

" The manner of uſing this corn in America, " is various. It has this advantage over wheat, " that ſubſiſtance may be drawn from your corn " fields long before the general harveſt: for the " green ears roaſted, are delicate food; and as " the corn ripens and grows harder, the ears " boiled are good eating, with butter and ſalt. " When it is ripe, the corn parched and ground " into meal, is the hunting and war proviſion of " the Indians; being light to carry, and affording " good nouriſhment. They mix a little of it with " water, and it needs no other cooking, having " already paſſed the fire in the parching. The " grain ſoaked in water, will part with it's ſkin " when beat in a large morter with a wooden " peſtle: then it is boiled and eaten with milk. " Being pounded coarſely, dry, it is alſo boiled " and eaten as rice. Bag puddings, and baked

" puddings made of it properly, are very good. " The meal is alſo boiled with water, to make " what they call a haſty pudding, which they eat " with butter and ſugar, or with milk. This haſty " pudding, or boiled meal, being mixed with " twice as much dry wheat flour, and worked into " loaves, makes much better and pleaſanter bread " than flour alone. All creatures fed with Indian " corn, have firm and fat fleſh: the pork of corn-" fed hogs is reckoned the fineſt in the world for " taſte and goodneſs; their fat is milk-white, and " as hard as butter. The horſes of Virginia and " Maryland, whoſe chief fodder is the leaves and " ſtalks of this corn, are reckoned the hardieſt of " the ſpecies, bearing moſt labour, and requiring " leaſt care; and the people of thoſe countries " where it is the common food of men, are " healthy, ſtrong, and hardy."

The Engliſh have alſo found out a way to make good beer, either of bread made of this corn, or by malting it. This laſt proceſs, of which farther notice will be taken when we come to ſpeak of malt and brewing, is ſomewhat difficult, on account of the great ſprouting of the grain at both ends: but to make beer with the bread of Maize, they only break or cut it into lumps about the bigneſs of a man's fiſt, maſh it, and then proceed as with malt, treating the impregnated liquor in the ſame manner as wort, with, or without, the addition of hops, as is beſt liked. The beer thus made is ſaid to be well coloured, wholſome pleaſant, and durable[s].

This corn is thought to keep better than wheat, and has frequently been of infinite ſervice in many countries in times of ſcarcity of other

[s] *Philoſoph. Tranſ. No.* 142.

grain.

grain *. It anſwers all the purpoſes of the white pea, of about the ſize of which it's grains are, and would certainly be a better ſubſtitute for the poor, than bean-flour, or ſome other ſorts, which have been uſed even in England, where maize may doubtleſs be cultivated to advantage in light ſandy lands, in which beans and peas do not thrive well. It is excellent for feeding poultry, either given whole to the larger ſort of fowls, or broken a little for the ſmaller. The Breſcians, in particular, who are remarkable for the fatneſs of their capons, uſe a great deal of it for this purpoſe. The Indians reckon it a good remedy in all acute diſorders; and it has been obſerved that thoſe people are very little ſubject to the ſtone; which ſome aſcribe to their living upon this corn. They extract from it's ſtalk, when green, a ſweet ſyrup, which anſwers all the ends of ſugar †; and when the ſtems are diveſted of their ears, and dried, they make excellent fences, coverings of ſheds, &c.

The Indians, and ſome Engliſh, particularly where the ground is good, and has been well manured with fiſh, plant with the maize, in every corn hill, a kind of french beans, which run up the ſtem of the corn, and are ſupported by it: others plant potatoes, gourds or pumkins, and others

* Many of the peaſants in Guyenne lived upon Maize for whole years, without finding any inconvenience from it: particularly in 1738, when all the wheat of that province was deſtroyed by hail; and in 1748, during the great ſcarcity of corn. The common way of uſing it there, for bread, is to mix about an eighth part, and ſometimes more, of Maize, with ſeven parts of wheat, or wheat and rye, to which it gives a ſavoury taſte. Bread, made of the flour of Maize alone is heavy and hard to digeſt, becauſe it's dough ferments very little, if at all.

DUHAMEL, *Tom.* III. *p.* 185.

† *Ibid.* and *Maiz. Ruſt. Tom.* I. *p.* 623.

again ſow turnips, in the intermediate ſpaces between the hills.

Some curious perſons, by way of experiment, have planted ſeeds of only one colour in the ſame field, without any other coloured ſeeds near them, and their produce has been intirely of the ſame colour: but when the rows have been planted alternately with grains of different colours, they have interchanged, and produced a mixture of all the ſorts in the ſame row, and frequently, as was ſaid before, on one and the ſame ſpike. It is even affirmed, that they will mix with each other at the diſtance of four or five rods, if no tall fence or building ſtands between, ſo as to intercept their communication.

Mr. Miller, who mentions this [u], very rightly recommends the horſe-hoeing huſbandry, as, in all reſpects, fitteſt for the culture of Maize; and gives the following, as a method in which it has ſucceeded beyond expectation.

The land, which was very light and ſandy, and far from being rich, was plowed deep before winter, and laid up in high ridges till the ſpring, when it was broken fine with the harrow. It was plowed again in April, laid level, harrowed ſmooth, and then ſowed in drills four feet aſunder, into which the ſeeds were dropped at the diſtance of about eight or nine inches from each other. When the plants were about three inches high, they were thinned with a hand-hoe, by cutting up ſome of them where they grew too cloſe, and the intervals between the rows were plowed ſhallow, to deſtroy the young weeds: but when the ſtems were advanced, the ground in the intervals was plowed deep, and the earth laid up to the plants on both ſides; and when the weeds began to

[u] *Gardener's Dictionary*, Art. ZEA.

grow

grow again, a third plowing was given, to deſtroy them. This kept the ground pretty clean from weeds till the corn was ripe, as the ſeaſon did not prove wet; for otherwiſe a fourth plowing would have been neceſſary. Each of the ſtalks of theſe plants produced from three to ſix ſpikes of grain.

Sir Richard Bulkley, who planted ſome of this corn in Ireland, from ſeed which grew in Brandenburg, had, from each of his grains, which were ſet a foot aſunder in rows about a yard diſtant from each other, from three to ſix ſtems, and upon each ſtem three ſpikes or ears of corn, with two hundred and forty grains in each ſpike [x]. An amazing increaſe!

Some good huſbandmen in France have cultivated this grain upon nearly the ſame principles as thoſe which Mr. Miller points out. The little differences in their methods may not be un-inſtructing: for which reaſon I ſhall here give the ſubſtance of M. Duhamel's account of their management of this corn:

"Maize thrives better in a light and ſandy ſoil, than in ſtiff and clayey land. It cannot do without dung; and the ground intended for it ſhould receive two good plowings in March [y]. A third plowing, which is given towards the end of April, makes the furrows for the ſeed; and what clods remain after this, are broken by hand, the furrows then preventing the uſe of a harrrow.

"A fine clear day is choſen in May, to ſow the ſeed, which is done by making at the bottom of the furrows, with a ſtick or other inſtrument, ſmall holes, into each of which two grains of maize are dropped. The furrows are a foot and a half aſunder; and the holes, at the ſame diſtance

x *Philoſoph. Tranſ. No.* 205.

y *Culture des Terres, Tom.* III. *p.* 179.

from

from each other, are diſpoſed in ſuch manner that they form a kind of quincunx.

"When the corn is riſen, the weakeſt of the two plants is plucked up, where both ſeeds have ſprung; and where neither of them has grown, two new grains are planted.

"Towards the middle of June, the ground is hand-hoed round each plant; and as they ſtand in the bottom of a furrow, the mould which crumbles down, from time to time, lays freſh earth to their roots, and helps to ſupport them. About the end of July, a ſlight hoeing is given them, which is the laſt; and in ſo doing the earth is laid toward the roots of the plants.

"The panicles of the male flowers, which grow at the top of each plant, and are well known not to contain any grain, are cut off about the middle of Auguſt. But care muſt be taken that the grain be impregnated before they are cut off; which may be known by the then turgid appearance of the outward covering of the ears: nor ſhould the panicles be cut off from all the plants at the ſame time; becauſe ſome of the ears are not impregnated till a fortnight after others. Theſe panicles are excellent food for cattle. When they are cut, or ſhortly after, all the leaves are ſtripped off the ſtalks, together with all the blighted and ſmutty ears: for it is ſaid that the good ears would not grow ſo large, nor the grains be ſo well nouriſhed, if they ſhould be left upon the ſtalks. All theſe leaves and ears are given as fodder to oxen; and it is remarkable, that thoſe creatures are fonder of the ſmutty ears than of all the reſt.

"The time for reaping maize is towards the end of September. The ears are then gathered by hand, and put into baſkets, in which they are carried and laid in heaps from ſpace to ſpace in the

the field; after which they are loaded in carts, carried home, and ſpread upon an even floor prepared for that purpoſe. They are then taken out of their ſheath or hood, and dried in the ſun before they are laid up in the granary; or elſe the grain is taken out at that time. Maize which has been well dried in the ſun will keep ſeveral years, and not be the leſs fit for ſowing. The granary ſhould be very dry, and the corn laid up in it ſhould be turned at leaſt every three months, to prevent it's growing muſty, or being attacked by inſects.

"There are two ways of taking out the grain. The firſt, which is the moſt expeditious, is by threſhing it with a flail: but in this method a great deal of the corn is broken or bruiſed. The ſecond, and more common, is by rubbing the ears hard againſt the edge of a flat piece of iron. This eaſily ſeparates the grains from the ſpike, or cob, without hurting them, and this remainder of the ear is very good food for oxen.

"As ſoon as the ears are gathered, the ſtalks remaining in the ground are plucked up, and laid by for winter fodder, for oxen. The field is afterward plowed up as ſoon as poſſible: it being the general opinion of farmers, that the roots of the maize would otherwiſe continue to ſuck up the rich particles of the earth. Whether this be true, or not, their notion is, that if this plowing ſhould be deferred, the next year's crop would certainly ſuffer by it.

"When maize is planted only for fodder, particularly of cows and oxen, it is ſowed very thick, and harrowed in, or covered with a rake, in a good ſoil, which has been plowed twice, and well dunged: but it is obſerved, that in theſe thick ſowings, all the female flowers are barren, and produce no grain: and it likewiſe is ſo great an impoveriſher

impoveriſher of land, that though the ground be dunged every time it is planted, wheat never does ſo well where this corn has grown, as in the neighbouring fields where it never was."

M. Aimen, M. D. in the province of Guyenne, where great quantities of this corn are raiſed, obſerves to M. Duhamel[2], 1, That it is important to ſow maize rather in the beginning than at the latter end, of May; becauſe, if it is ſowed early, the plants will have acquired ſufficient ſtrength before the great heats, to ſhoot out then with vigour; nor will their ears be burnt, or liable to that barreneſs to which they are ſubject when this corn is ſowed late; beſides which, the ſtalks will be ſtronger, and their ears larger and fuller of grain. 2, That the ears of maize are greatly hurt by cutting the panicles too late; and that they ought to be cut before the hoods are open. By leaving a plant with it's male flowers at every twenty feet diſtance, all the female ears will be impregnated.

In two different, but ſucceſſive years, this gentleman ſingled out two rows of maize, the plants of which ſeemed to him equally ſtrong. He cut off the panicles of the male flowers of all the plants in the firſt row, before their hoods opened, and let the panicles of the other row remain till the uſual time of performing this operation: the conſequence was, that the female ears of the firſt row were much the largeſt and beſt filled with grain.

He likewiſe ſowed a row of maize at a diſtance from any other field planted with that corn, and cut off the panicles of that row before the hoods were opened; leaving only one plant with it's male flowers at every twenty feet diſtance. At

[2] *Ibid.* p. 187.

harveſt,

harveſt, he obſerved, 1. That all the female ears of all the plants were impregnated: 2, That the female ears of the plants which had loſt their male panicles early, were thicker, longer, and fuller of corn, than any others: 3, That the female ears of the plants whoſe panicles had been cut late, were ſmaller and ſhorter, and that in ſome parts of them the grains were abortive.

To ſatisfy himſelf whether it be beſt to ſow maize thick, or thin, he planted three different ſpots of ground with this corn, on the third of April 1753. The ſeed uſed for the firſt, where the grains were placed about a foot and a half aſunder, according to the common practice of the country, in which experience had inſtructed the huſbandman, weighed one ounce and one penny weight: the ſecond, in which the grains were only a foot aſunder, was ſowed with two ounces and two penny weights of ſeed: and the third, in which they were but ſix inches apart, was ſowed with four ounces and a half.—— The firſt of theſe ſpots produced eighteen pounds and four ounces of grain; the ſecond fifteen pounds ſeven ounces; and the third, eleven pounds two ounces.—A manifeſt proof, as M. Duhamel obſerves[a], that ſome ſorts of grain not will do well unleſs they are ſown very thin; and that, for want of this precaution, a great deal of corn is often loſt, and the crops are conſiderably diminiſhed.

As maize is a large plant, and requires much nouriſhment, it would certainly be right to try the culture of it with the horſe-hoe, of which, and of the manner of uſing it, a deſcription will be given in the beginning of the next volume. To this end, it will be proper to plant the rows two feet

[a] *Ibid. p.* 212.

aſunder

aſunder, and the grains in them twelve or fourteen inches apart. All the neceſſary hoeings may then be given with the cultivator drawn by one horſe; and I believe, with Mr. Miller, M. Aimen, and M. Duhamel, that the corn will thrive the better for it, and the land be afterwards fitter for other grain. It is worth the while of thoſe who live in countries where maize is cultivated, to try what will be the effect of this method.

Millet.

This plant, which grows naturally in India, from whence it was firſt imported into Europe, is greatly cultivated in Italy, Spain, and the ſouthern parts of France, for the food of men, as well as for that of poultry, and we alſo raiſe it in ſeveral places in England; though we have our annual ſupply of this grain from the Eaſt-Indies, which makes ſome people erroneouſly call it Eaſt-India wheat.

It delights in a light ſandy ſoil, prepared in the ſame manner as for maize; and in ſuch land, it branches out into many ſtalks, ſometimes thirty or forty, not unlike reeds either in their ſhape or leaves, of which there is one at each joint. The top of each ſtalk is terminated by a large looſe panicle, which hangs on one ſide, with a chaffy flower, which is ſucceeded by a ſmall round ſeed, about the bigneſs of turnip or cabbage ſeed, of a yellowiſh white colour in one ſort, and of a dark red, inclining to black, in another. The ſmall millet, and the large, a diſtinction which ſome writers make, are only varieties of the ſame ſort. It is likewiſe ſaid to thrive extremely well in ſtrong land: but will not do in ſtony ground, or where the bottom is either chalk or clay [a].

[a] *Maiſons Ruſtiques, Tom.* I *p.* 625.

Mr.

Mr. Miller [b] directs ſowing this grain in the beginning of April, which may be very right in this country, that it may be ripe in Auguſt: but in warmer climates, the general rule is to ſow it either between the middle and the end of May, or at Midſummer. The former is reaped at the end of September, and the latter about the end of October.

The ſeed is ſowed in furrows, very thin, and covered with the plough or rake. The largeſt ſort ſhould be ſowed thinneſt, becauſe it branches moſt. When the plants are about a month old, the ground ſhould be ſtirred round them with a hand-hoe, as well to lay freſh earth to their roots, for they require a great deal of nouriſhment, as to clear them from weeds, of which they will afterwards prevent any great increaſe, by over-topping them. At the ſame time, the millet ſhould be thinned wherever it grows too cloſe, ſo as to leave, in general about ſix inches between each plant. The huſbandman has nothing more to do to this grain till harveſt, excepting that, when it begins to ripen, he muſt take great care to protect it from birds, which would otherwiſe ſoon devour it. If preſerved from them, the returns are very great; for it is not eaſily hurt by drought or rain, nor is it ſubject to blight. Frequent ſhowers of rain are of great ſervice to it whilſt growing.

When the millet is ripe, it's panicles are cut off near the uppermoſt joint of the ſtalk, with a knife, and put into baſkets or ſacks, in which they are carried home. They are then laid up in heaps, covered over with cloths, and, after remaining in that ſituation five or ſix days, are ſpread upon the barn floor, threſhed out with a flail, and cleanſed,

[b] *Gardener's Dict.* Art. MILIUM.

like

like other grain. Great care muſt be taken to dry it well in the ſun, before it is laid up in the granary: for it would ſoon ſpoil if the leaſt moiſture were left in it; this being of all grains the moſt difficult to keep, unleſs it be thoroughly dry: and on the other hand, none keeps longer or better, after it has been well dried. It is not liable to the weevil: and though it ſhould be turned from time to time in the granary, yet, if that happens now and then to be neglected, it ſtill keeps perfectly well.

It has been a conſtant obſervation, that the late ſown millet, I mean ſo late as Midſummer, had always had the greateſt number of abortive grains, that it's panicles are ſmaller than thoſe of the ſame grain ſowed earlier, and that the crop is leſs plentiful.

The ſmall white millet, which is by far the moſt delicate, and of which excellent puddings, &c. are made, is the ſort chiefly cultivated in this country. The red, which is much larger and coarſer, is not uſed here, except, perhaps, for pigeons, poultry, and ſwine, for which laſt it ſhould be ground to meal: but the peaſants about Bourdeaux, where a great deal of it is raiſed in the poor light lands near that city, make of it a reddiſh, heavy, ill-taſted bread, difficult to digeſt. The culture of this ſort, which is Mr. Miller's *Sorgum*[d], is, in all reſpects, the ſame as that of the white; excepting that, as it grows much larger, the plants require more room.

Millet, either green, or after it's grain is threſhed out, is very good fodder for cattle, for which uſe it may be ſowed thicker than for a crop of grain. It's many roots, large ſize, and quick growth, are ſaid to render it a great impoveriſher

[d] *Gardener's Dict.* Art. Holcus.

of

of the earth; for which reaſon ſome people pull up the roots, and plow the ground immediately, as ſoon as the crop is reaped: but others, more judicious, plow in the ſtubble and roots, which rot, and greatly enrich the ſoil: nor can I but incline to think, that this, and indeed all other ſucculent plants, inſtead of being ſuch robbers as is commonly ſuppoſed, return to the earth, by the inſpiration of their leaves and perſpiration of their roots, even while they grow, perhaps as much as they borrow from it: for how ſhould it be poſſible for them to pierce into the very drieſt and hardeſt ground, as we frequently ſee they do, unleſs they perſpire moiſture through their roots? As this plant requires a great deal of nouriſhment, it would probably thrive beſt in the horſe-hoeing huſbandry.

Panic.

This plant reſembles millet in it's ſtalks, leaves and roots; but differs in it's ſpikes, or ears, which are about the thickneſs of a man's finger at their baſe, grow taper toward their points, are about eight or nine inches long, and cloſely ſet with a ſmall roundiſh grain, ſometimes white, ſometimes red or purple, and ſometimes yellow. It is raiſed and reaped in the ſame manner as millet, but does not require ſo much rain. This plant grows naturally in both the Indies, and is cultivated in ſeveral parts of Europe for the food of men. Cakes and bread are made of it in Germany, Italy, and the ſouthern parts of France; but it is not reckoned ſo good nouriſhment as millet: nor is the German ſort ſo much eſteemed as the Italian; though the former ripens beſt in cold countries, where it is frequently ſowed in land which will not produce better grain. It thrives moſt in a dry ſtiffiſh ſoil, ſuch as the ſides of hills, and even in ſtony

ground; grows to the height of about four feet, and branches very much; for which reaſon the horſe-hoeing huſbandry is by far the fitteſt for it. The plants, if managed rightly, ſhould ſtand at leaſt eighteen inches aſunder, in rows three feet apart, that there may be room to hoe the ground between them, and to keep them clear from weeds. When grown pretty tall, they ſhould be ſupported by ſtakes, leſt the wind break them down, and particular care muſt be taken to guard againſt birds when their ſeeds begin to ripen.

Rice.

This grain, which is the principal food of the numerous nations of the Eaſt, of which part of the world it is a native, will grow in any light and naturally moiſt ſoil, provided the climate be warm, and the ſituation of the ground ſuch as to admit of it's being overflowed at pleaſure: but it is too tender to be produced in the field in northern countries. The richneſs or poorneſs of the land are ſaid to be immaterial, becauſe it is ſufficiently fertilized by the water which is let in upon it; to which end the rice-field ſhould always lie near a rivulet or large pond, and be interſected by trenches or channels to carry off the water, or at leaſt lower it, when neceſſary. This land muſt have three deep plowings, to render it looſe and fine; and at the ſame time it is laid ſmooth, with a gentle ſlope, to facilitate the running of the water. The laſt plowing ſhould be given in the beginning of April, immediately before the ſowing of the ſeed, which ſhould be put into the earth quite wet, after having been ſoaked in water during twenty four hours. The ground is then overflowed to the depth of about an inch and a half; and nearly the ſame quantity

of

of water is kept upon it till the ears begin to form, when the flooding is increaſed, to keep the plants from intangling and being ſpoiled. All the water is drained off a few days before the time of reaping, which generally is in the beginning of September: and the ſame land thus managed will produce equally good crops of rice during three ſucceſſive years, at the end of which, being then in a richer ſtate and freer from weeds and inſects, than it was before the planting of the rice, it will bear excellent wheat, or meſlin; for two or three years more [a].

Such is the general method of cultivating this plant in Spain, Italy, and Piémont, where great quantities of rice are raiſed every year. How far it may differ from, or agree with the practice of our induſtrious planters in ſuch parts of America as are fit to produce this grain, is more than I can pretend to ſay; for I confeſs myſelf totally ignorant in reſpect to this laſt, and ſhall be highly obliged to any ingenious gentleman of that country who will pleaſe to favour me with inſtructions relative thereto. The rice which has been ſent hither from South-Carolina, is allowed to be as good as any imported from the Eaſt; and therefore it becomes an important national concern.

In this light I think it incumbent on me to add here, in hopes that it may poſſibly ſuggeſt ſome new and uſeful hint for farther improvements in the culture of this very wholſome and profitable grain, the juſtly celebrated M. Duhamel's authentic account of the manner in which it is raiſed in China.

"My printer", ſays that truly ingenious and judicious gentleman [b], "having received from "China two books of drawings, in which the cul-

[a] *Maiſons ruſtiques, Tom.* I. *p.* 704.

[b] *Culture des Terres, Tom.* II. *p.* 180.

" ture of rice is repreſented, and the ſubject briefly " explained in Chineſe verſes; father Foureau, a " Jeſuit, who lived ten years in that country, has " been ſo kind as to tranſlate them; which enables " me to form a clear of all the operations relative " that culture.

" 1. To haſten the ſprouting of the rice, it is put into baſkets, and ſoaked for ſome days in a ſtanding water.

" 2. When their rice grounds are ſo ſoaked with water as to be quite like mud, they plow them with a buffulo yoked to a plough very ſimple in it's make, having but one ſhare, one handle, and no wheels.

" 3. After a gentle rain, they break the clods with a kind of large hurdle, drawn by a buffalo; the driver ſitting upon it, to increaſe the weight.

" 4. The ground is cleared of all ſtones, and whatever roots are in it are pulled up by a ſtrong harrow, with great iron teeth. This inſtrument is drawn by a buffalo, and a man guides it with the help of two handles, like thoſe of a plough, upon which he leans hard. The earth is like mud, and partly covered with water during all this operation.

" 5. The earth is afterwards ſmoothed with a harrow, which has ſeveral rows of teeth. A man guides this harrow by it's two handles, whilſt a buffalo draws it; and as faſt as it's teeth form little channels in the ground, the water runs in, and fills them up.

" 6. When the rice that was laid to ſoak has ſprouted, the ſeed is known to be good; and it is then ſown by hand, very thick, and as equally as poſſible. Only part of the ground is ſown in this manner, to furniſh plants for the reſt.

" The day after it has been ſown, the points of the plants appear above the ſurface of the water: for the ground is overflowed all this time with juſt enough water to cover it.

" 7. When

"7. When the plants have acquired a little ſtrength, they are ſprinkled with lime water, to deſtroy the inſects and ſome of the weeds that would hurt them. For this purpoſe a ſmall baſket is faſtened to the end of a long handle, and dipt in the lime water, which runs through it, as it is conveyed over the plants.

"The Chineſe have a great veneration for the firſt inventor of this method, which anſwers to our cuſtom of ſteeping wheat in lime-water, or manuring land with quick-lime.

"8. Towards April, when the plants are grown ſtrong enough to cover the whole field, and look very green and even, the greateſt part of them is pulled up by handfuls, all the mud is carefully waſhed off their roots, and, being held all this time as even as poſſible with one another, they are planted in tufts, pretty far aſunder, and in a quincunx form, in fields prepared on purpoſe for them. A ſerene day is choſen for this operation, which muſt be performed as quick as poſſible.

"This practice of the Chineſe is with reſpect to the common culture of rice, what the new huſbandry is with reſpect to the common culture of wheat.

"9. The rice muſt be watered: which is always done in China, by overflowing it. To this end, the rice grounds are always near a rivulet, pond, or great pool of water, from which they are ſeparated only by a bank or cauſey.

"If the water was higher than the rice ground, a trench cut through the cauſey would overflow it at once: but as it is generally lower, or on a level with the rice ground, the neceſſary quantity is conveyed in pails or buckets, which are worked chiefly by the help of ropes *. "10.

* This agrees nearly with Mr. Boyle's obſervation c, that the Chineſe water their rice-fields by means of moveable mills,

c *Abridg. Vol.* I. *p.* 108.

"10. Though a man cannot ſtep in theſe rice grounds without being up to his knees, the Chineſe weed them three times in a ſummer; and that with ſuch care, that they pull up even the roots of every weed.

"11. When the rice is ripe, which is known by it's turning yellow like wheat, it is cut down with a ſickle, made into ſheaves, and carried to a barn, where it is threſhed with flails pretty much like ours: the ſtraw is removed with pitch-forks and ſhovels, and the outer huſk of the grain is taken off by beating it with great wooden peſtles, or a kind of mallet, after which it is ſifted and winnowed: and laſtly, to get off the under huſk, the grain is put between two mill ſtones, which are worked by a lever faſtened to the upper one †.

"The two moſt remarkable circumſtances of this culture are, 1. The care which the Chineſe take not to let their plants be too cloſe together, leſt they ſhould rob one another of their food. 2. Their weeding their rice grounds three times in a ſummer, which anſwers the end of the hoeings recommended for the alleys between the beds of other grain, cultivated according to the new Huſbandry."

Rice grows to the height of about two feet and a half, with a ſtalk not unlike that of wheat, but fuller of joints, and with leaves reſembling

placed as occaſion requires, upon any part of the banks of a river, and that the water is raiſed in buckets to a proper height, from whence it is conveyed in channels to the deſtined places; which is certainly the moſt expeditious and leaſt laborious way.

† Mr. Chamber's ſays that, in the Indies, the women threſh and dreſs the rice; a very painful office, which the men leave to them either out of idleneſs, or diſreſpect.

Cyclopæd. Art. RICE.

thoſe

thoſe of a leek. It branches out into ſeveral ſtems, at the top of which the grains, ſomewhat ſmaller than wheat, grow in cluſters, and each of them is terminated with an awn or beard, and incloſed in a yellow rough huſk. When ſtripped of this, they appear almoſt oval, of a ſhinning white colour, and ſomewhat tranſparent. The beſt is that which, when thus cleanſed, is neateſt, whiteſt, largeſt, and hardeſt; which ſwells moſt, and ſooneſt, when boiled; and, in countries to which it is brought from a-far, that which is freſheſt, leaſt duſty, and freeſt from any diſagreeable ſmell.

Beſides being, as I obſerved before, the chief ſuſtenance of the Aſiatics, whom it ſerves inſtead of bread, and who cook it with almoſt every kind of diſh; vaſt quantities of this grain are eaten in all roman catholic countries, on faſt days, and in time of lent. The ordinary preparation is by firſt ſteeping it in water, and then boiling it in milk. Some make it into a ſort of flower, by pounding it in a mortar, after having firſt ſteeped it in hot water, and again waſhed it out in cold. We uſe and eſteem it for ſoups, puddings, &c. either whole for the former, or ſometimes cracked in a mill for the latter. The northern nations are remarkably fond of it with their fowls and other meats, with ſaffron; and formerly there was not a marriage feaſt among them without this mixture. Rice is alſo of ſome uſe in medicine; being eſteemed proper to ſoften and thicken ſharp humours, to moderate fluxes of the belly, &c. The Chineſe make of it a wine, which is of an amber colour, taſtes like Spaniſh wine, and ſerves them for their common drink; but is very intoxicating, if drank without water. In ſome parts of Europe, a ſtrong ſpirit is drawn from rice; but

arac is not made from it; as ſome miſtakenly imagine*.

Buck-Wheat.

This plant, though generally ranked as a ſpecies of corn, is not ſuch in fact, nor does it grow like any of the eſculent grains. It's leaf, from being roundiſh at firſt, takes nearly the ſhape of that of ivy, than which it is, however, longer pointed, and much ſofter. It's ſtalk is round, hollow, and weak, ſometimes reddiſh, but moſt commonly green, and it grows to the height of about two feet and a half. Lateral branches, which ſhoot out at almoſt every joint, are terminated by purpliſh flowers, which are ſucceeded by ſmall triangular ſeeds, black on the outſide, and white with-

* The nature and compoſition of this celebrated liquor, which is imported from the Eaſt Indies, and uſed chiefly by way of dram, or in punch, has been greatly controverted.—Mr. Lockyer aſſures us that the name *arac* is an Indian word for ſtrong waters of all kinds; for that they call our ſpirits and brandy, *Engliſh arac*. — But what we underſtand by the name *arac*, is really no other than a ſpirit procured by diſtillation, from a vegetable juice called *toddy*, which flows by inciſion out of the cocoa nut tree, and ſome other trees, like the birch-juice procured among us.

The *toddy*, Mr. Lockyer adds, is of itſelf a pleaſant drink, when new, but purges thoſe who are not uſed to it; and, when ſtale, it is heady; and finally it makes good vinegar. The Engliſh at Madraſs uſe it as leven to raiſe their bread with.

Goa and Batavia are the chief places for arac. — At Goa, there are divers kinds; ſingle, double, and treble diſtilled. The double diſtilled, which is that commonly ſent abroad, is but a weak ſpirit in compariſon with Batavia arac; yet is preferred to all the other aracs of India, on account of it's peculiar and agreeable flavour. This is attributed to the earthen veſſels, which alone they uſe at Goa to draw the ſpirit; whereas at Batavia they uſe copper ſtills.

The Parier arac, made at Madraſs, and the Columbo and Quilone arac, at other places, being fiery hot ſpirits, are little valued by the Europeans, and therefore rarely imported; tho' highly prized among the natives.

CHAMBERS *Cyclæpedia* Art. ARAC.

within,

within. It will thrive in any ſoil, not excepting even barren ſands, as they are commonly termed; but grows largeſt in dry ground which has been well plowed. When raiſed for it's grain only, a buſhel of ſeed is ſufficient for an acre of land, which will frequently yield fifty or ſixty buſhels [a]: but when it is intended for green fodder, which is the uſe moſt commonly made of it here, ſome people ſow three or four buſhels on an acre, in order to have a thick crop. The uſual time of ſowing it is about the beginning of May: but if it be ſowed ſomewhat earlier, and a warm ſeaſon enſues, it will bear cutting twice in the ſummer [b]. It comes up ſoon, and ripens in a ſhort time [c]. When mowed, it muſt be left in the field ſeveral days, that it's ſtalk may dry, before it is houſed. It's ſeeds do not eaſily fall off, nor is it much injured by wet. Theſe ſeeds are excellent food for pigeons, poultry, hogs, rabbits, &c. and are found to make horſes thrive when given among their oats: but for theſe they ſhould be juſt cracked in a mill; being apt, otherwiſe, to paſs through them whole. The flour of this grain is very white, and makes a good ſort of pancake when mixed with a little wheat-flour. The poor, in ſome countries, make even bread of this mixture: but it is black, bitter, windy, and not nouriſhing [d]. It's ſtraw, or haulm, is alſo given dry to cattle: but the beſt way is to feed it whilſt green, particularly juſt before it bloſſoms. Milch-cows fed with it will yield an extraordinary quantity of milk, remarkably good for making butter and cheeſe: and another advantange attending this paſture, is, that it will continue green in the drieſt

a MORTIMER. *Vol.* I. *p.* 136. b *Maiſons ruſtiques, Tom.* I. *p.* 624. c RAY, *Synops. p.* 182.
d *Maiſons ruſtiques, ubi ſupra.*

time

time of ſummer, when other graſs is burnt up. It is an excellent dreſſing for land, when plowed in without being mowed [e].

The authors of the *Maiſons ruſtiques* obſerve [f] that pheaſants are exceſſive fond of this grain, and that many gentlemen in France ſow it in open parts of their woods, purpoſely to draw them thither.

ARTICLE III.

Of the Culture of Pulſe.

Beans.

WE know but two diſtinct ſpecies of what are properly called beans, *viz.* the garden-bean and the horſe-bean. The ſeveral varieties of the former, for Mr. Miller, after more than thirty years experience, is ſatisfied that they are only varieties [a], will be noticed more particularly hereafter, in the article of *Gardening*, to which they properly belong: for this ſpecies is not commonly cultivated in the field, like the horſe-bean, which is deemed the more immediate province of the huſbandman.

Horſe-beans delight in a ſtrong moiſt ſoil, and an open expoſure; for they never thrive well on dry warm land, or in ſmall incloſures, where they are very ſubject to blight, and are frequently attacked by a black inſect, which the farmers call the black dolphin. Theſe inſects are often in ſuch quantities, as to cover the ſtems of the beans entirely, eſpecially all the upper part of them; and wherever this happens, the beans ſeldom do well; but it rarely is the caſe in open fields, where the ſoil is ſtrong.

[e] MORTIMER, *ubi ſupra.* § 624.
[a] *Gardener's Dict.* Art. FABA.

Theſe

Theſe beans are uſually ſown on land newly broken up, becauſe they help to looſen and pulverize the earth, and to deſtroy weeds; ſo that the ground is rendered much fitter for corn, after a crop of beans, than it would have been before, eſpecially if they are ſown and managed according to the new huſbandry, with a drill-plough, and the horſe-hoe, by means of which a much greater crop will alſo be obtained [b].

The ſeaſon for ſowing beans is from the middle of February to the end of March, according to the nature of the ſoil: the ſtrongeſt and wet-land ſhould always be laſt ſown. The uſual quantity ſown in the old huſbandry is about three buſhels to an acre; and the common produce is about twenty buſhels.

If the land be newly broken up, the cuſtom is to plow it early in autumn, to let it lie in ridges till after Chriſtmas, and then to plow it in ſmall furrows, and lay it ſmooth. Theſe two plowings will break it fine enough for beans, which, at the third plowing, are ſown after the plough, in the bottom of the furrows, which ſhould not then be made above five, or at moſt, ſix inches deep. This is the uſual method: though ſome lay their beans before the plough, and then plough them in: but in either of theſe ways they are ſet as cloſe as the furrows are made, which is much too near; for when they are on ſtrong good land, they generally are drawn up to a very great height, and are not ſo apt to pod, as when they have more room, and are of lower growth. Some late trials have convinced Mr. Miller, that it is much better to make the furrows two feet aſunder, or even more; that the beans will then branch out into many ſtalks, and bear in greater plenty; and that, the ſun and air having by this means freer

[b] *Id. Ibid.*

ad-

admittance between the rows, they will ripen much earlier, and more equally, than when they are planted cloſer together, as is the common way. But in either of theſe methods, particular care ſhould always be taken to cover them perfectly with earth; for if a bean lies hollow, it waſtes itſelf before it reaches the mould ſo as to ſhoot upward. The authors of the *maiſons ruſtiques* think [c] that the fertility of beans is greatly increaſed by ſteeping them before they are ſown.

When they are planted according to the new huſbandry, the ground ſhould be plowed four times before they are ſet. This will break the clods, and render it much fitter for planting. They ſhould then be ſet with a drill plough, ſo ordered as to drop them regularly at three inches diſtance from each other in the drills; by which method leſs than one buſhel of ſeed will plant an acre of land. When the beans are up, the ground ſhould be ſtirred between the rows, with a horſe-hoe, to deſtroy the young weeds; and when theſe are about three or four inches high, they ſhould be earthed up by another plowing between the rows. A third plowing, about five or ſix weeks after this, will keep the ground clean from weeds, and make the plants ſtalk out and produce abundantly. An acre of beans cultivated in this manner will generally yield at leaſt ten buſhels more than in the common method, in which laſt it may almoſt always be obſerved, that more than half of their ſtems have no beans on them; for, by ſtanding cloſe, they are drawn up very tall, and only the tops of the ſtalks produce, whilſt all the lower part is naked; whereas, in the new huſbandry, the joints of the ſtems are ſhorter, the pods conſequently grow nearer together, and they bear almoſt cloſe to the ground.

[c] *Tom.* I. *p.* 674.

When

When the beans are ripe, they are reaped with a hook, as is uſually practiſed for peas: though ſome think[d] it is beſt to cut them a little before they are full ripe, to prevent their ſhedding afterwards when they are moved. After having laid a few days on the ground, they are turned; and this muſt be repeated ſeveral times, until they are dry enough to ſtack: but the beſt method is to tie them up in ſmall bundles, and ſet them upright; for in this caſe they will not be in ſo much danger of ſuffering by wet, as when they lie on the ground; and will be more hardy to carry to ſtack, than if they were looſe. They ſhould lie in the mow to ſweat before they are threſhed out; for as their haulm is very large and ſucculent, ſo it is very apt to give, and grow moiſt: but there is no danger of the beans receiving any damage, if they are ſtacked tolerably dry; becauſe the pods will preſerve them from injury, and the ſweating ſerves only to make them threſh the eaſier: for they will not ever give again, after they have once ſweated, and are dry.

It is with beans of every kind, as with other plants, beſt to change the ſeed from time to time, and not to ſow and ſave the ſeeds of the ſame ſort long in the ſame ground, for they do not then ſucceed ſo well. Judicious huſbandmen are therefore ſtudious to procure their ſeed beans from land of a different nature from that in which they are to be ſown, and find that, by this means, their crops are larger, and their beans fairer, and leſs apt to degenerate.

The principal uſe of horſe-beans is implied by their name: but as they are of a hot nature, care ſhould be taken not to give them in too great quantities to that valuable race of cattle. Their

[d] LISLE, *Vol.* I. *p.* 298.

ſtalks

ſtalks are likewiſe uſed ſometimes for fodder [e], in countries where there is a ſcarcity of graſs; and, when plowed in green, for which purpoſe only are they frequently ſown, they prove an excellent manure.

Mr. Liſle [f] ſeems to agree with thoſe who think that horſe-beans, of which he allows even five buſhels to an acre, yield a more certain produce than peas, generally double the quantity, and that broad clover will grow very well when ſowed with them.

But few trials have yet been made to raiſe either garden beans, or kidney-beans, in the open field; though ſome of M. Duhamel's correſpondents have found them anſwer extremely well when cultivated according to the new huſbandry. M. Eyma, in particular [g], planted in December 1755, near Bourdeaux, the common ſort of garden-beans, in a middling ſoil, not dunged, but thoroughly plowed a foot deep. The rows were two feet aſunder, and the plants a foot diſtant, from each other. Theſe beans, which every one thought too thin ſown, being aſſiſted by frequent hoeings, yielded a greater crop than any in the common way. When they began to ripen, M. Eyma gave the ſpaces between them a good plowing, and on the twenty-third of June, ſowed in each of them a row of red kidney-beans, which came up very well. In a fortnight after, he plucked up the garden beans, and gave the ground on which they ſtood a ſlight hoeing. Theſe kidney beans proved the fineſt he ever ſaw. He repeated the ſame experiment in 1756, and was rewarded with ſuch ſucceſs, as even ſurpaſſed his utmoſt expectation. In other parts of France,

[e] *Maiſons ruſt. Tom.* I. *p.* 673.
[f] *Obſervations in Huſbandry, Vol.* I. *p.* 298.
[g] *Culture de Terres, Tom.* V. *p.* 81.

the

the common ſmall white garden bean is ſowed in the fields in autumn, thrives well, and, though cultivated only in the common way, yields ſuch plentiful crops that the country people there even prefer it to any other ſort [h]. This, probably, is the kind meant by the perſon who told the Rev. Dr. Eliot [i], that half a peck of the little round white beans, mixed with a buſhel of rye, will make bread ſomewhat like wheat. The Doctor adds, that he has not tried it, but deſigns to ſee what it will do.

In like manner I would here adviſe our intelligent huſbandmen to try, perhaps more than they have yet done, though ſtill cautiouſly, what ſucceſs will attend the culture of the garden bean in the field, when planted at ſuch diſtances as to uſe a horſe-hoe between the rows. Moſt of them know, without my ſaying it, that all ſuckers which come out from the roots of theſe beans, ſhould be carefully taken off when the plants are about a foot high; and that, when the bloſſoms begin to open toward the bottom of the ſtalks, the top of the ſtems ſhould be pinched off, in order to make the pods ſtand and fill. For want of this, there have been inſtances of beans which have run up to a great height, and have not produced any ſeed. With proper care, ſuch as enriching the ground with a warm manure, drilling the beans in ſufficiently diſtant rows, at a ſeaſon when the young plants will not be expoſed to be killed by froſts, and keeping them free from weeds by horſe-hoeing the intermediate ſpaces, there ſeems to be little danger of their doing otherwiſe than well.

h *Maiſons ruſt. Tom.* I. *p.* 672.

i *Eſſays upon Field-Huſbandry, p.* 14. *2d. Edit.*

Peas.

Peas.

As the culture of peas in the garden will be treated of hereafter, when their ſeveral ſorts, and the means of raiſing a regular ſucceſſion of crops for the table will be particularly noticed; I ſhall here confine myſelf only to what relates to the management of them in the field.

Mr. Liſle, for the greater eaſe and more certain guidance of country people, who are apt to be perplexed by a long liſt of particular names of different ſorts of field-peas, and of their ſeveral numerous varieties, judiciouſly ranges them under two general heads[k] *viz.* the tender and the hardy ſmall ſort, and the tender and the hardy great ſort; under the one or the other of which claſſes he thinks all kind of peas may properly be ranked, becauſe they equally agree or diſagree with the ſame ſoil. The tender pea, for example, is improper for a cold country, or, which amounts to the ſame, for cold ground in a warm country: and the large pea, by reaſon of it's great haulm, is not proper for ſtrong rich land, becauſe it's haulm will there increaſe to ſo great a length, that it will not be able to bear pods. His own experience in the year 1704, ſatisfied him fully that the beſt way to make peas pod well, is to ſow them on a mellow mould, rendered light by plowing: and he thinks it right to roll the ground ſoon after they are ſown.

Even the moſt general directions, and therefore theſe cannot but be of ſervice to the husbandman: but more particular obſervations and actual experiments properly diverſified, are ſtill much wanted in the culture of this, and indeed of all

k *Obſervations in Huſbandry, Vol.* I. *p.* 303.

other

other podded grains, and ſucculent plants, whoſe importance, as deſtroyers of weeds, improvers of land, and excellent preparers of it for other crops, is eſtabliſhed beyond diſpute *. It is even a rule with farmers, not to ſow the ſame land a ſecond time with peas, till ſix, or at leaſt five years after the former crop of the ſame kind; becauſe, till then, the ground on which they grew will continue ſo rich as to make them run luxuriantly to haulm, in a manner inconſiſtent with the bearing of much fruit.

The common white pea does beſt on light ſandy land, or on a rich looſe ſoil. It is generally ſown with a broad caſt, and only harrowed in. Three buſhels of theſe peas are the uſual allowance of ſeed for an acre of ground; and the common time for ſowing them is about the latter end of March, or the beginning of April, on warm land: but a fortnight or three weeks later than this, will be early enough on cold ground. If ſown in drills, which is by far the beſt way, a buſhel and

* They are found to be ſuch inrichers of the earth, and to prepare it ſo well for corn, that the reverend Dr. Eliot of New England ſays he has many times known farmers (in that country) invite others, who had peas, to ſow their land without paying any rent, merely for the advantage it would be of to their crop of wheat. "Peas," continues he, accounting philoſophically for the means by which they are ſuch improvers of land, "make a ſhade, and where the ground is ſhaded, the air "will be condenſed, and, conſequently, make room for the "ruſhing in of more air; ſo that in this ſhade there will be a "greater lodgement of the nitrous ſalts, and conſequently the "land will be made rich. The ſame is found by experience "to be true of potatoes, which are therefore accounted to be "inrichers of land. — It will be aſked, if ſo, why do not "weeds, which make ſhades, inrich the ground? The rea-"ſon is plain; *viz.* becauſe the land is not tilled, and ſo "prepared to receive and retain the fertilizing dews and ſalts "of the air." *Eſſays on Field-Huſbandry, p.* 112.

* Evaporation is prevented - the nutritious deposit of grain dews &c is retained - a kind of fermentation is promoted The soil is not only enriched but actually tilled

a half of ſeed will be full enough for an acre; and, when they are thus ſet regularly, the ground may be ſtirred with a hoe, to deſtroy the weeds, and earth up the plants, by which they will be greatly improved, and the peas will be much eaſier to cut in autumn, when they are ripe.

The green and the maple rouncivals require a ſtronger ſoil than the white, and ſhould be ſown a little later in the ſpring, alſo in drills, but farther aſunder, that is to ſay, at the diſtance of at leaſt two feet and a half, or three feet from each other, becauſe they are apt to grow rank, eſpecially in a wet ſeaſon. The ground between theſe rows ſhould be ſtirred two or three times with a hoe, which will not only deſtroy the weeds, but, by earthing up the peas, will greatly improve them, and alſo render the land fitter to receive whatever crop is put on it the following ſeaſon.

The gray and other large winter peas, as they are called, are ſeldom cultivated in gardens, becauſe they require a great deal of room. The beſt time for ſowing of theſe is about the beginning of March, when the weather is pretty dry; for if they are ſown in a very wet ſeaſon, they are apt to rot, eſpecially if the ground be cold. The diſtance between the rows ſhould here be at leaſt three feet, and theſe peas ſhould be ſown very thin in the rows: for if they are ſown too thick, their haulm will ſpread ſo as to fill the ground, and they will ramble over each other; by which means many of the plants will be rotted, and hindered from bearing. The common allowance of theſe large peas, is two buſhels to an acre: but that is certainly more than conſiſts with the very thin ſowing which is beſt for them.

The gray peas, in particular, thrive beſt on a ſtrong clayey land, in which they are commonly ſown under furrow. But by this method of ſowing,

ing, large peas, eſpecially, are always planted too thick, and at unequal depths, which prevent their coming up regularly. For this reaſon, among many others, all rank-growing plants, ſhould undoubtedly be ſown in drills, in which their ſeeds will be diſtributed much more equally in all reſpects.

If only a ſmall ſpot of ground be planted with theſe peas, a channel about two inches deep may be made with a hoe, guided by a line, the ſeeds may be dropped therein, and the earth may be drawn over them with a rake. By this means they will be covered equally, and with tolerable diſpatch, though not ſufficient for large fields, where, for this reaſon, a ſhallow furrow is commonly made with the plough, the ſeeds are ſcattered in it, and the earth is harrowed over them. The greateſt trouble then remaining is to keep the plants clear from weeds, and lay the earth up to their roots, which, in countries where labour is dear, is very expenſive to have done with the hand-hoe, but may be eaſily effected by drawing a horſe-hoe between the rows. This will entirely eradicate the weeds, ſtir the ſoil, render it mellow, and greatly promote the proper growth of the plants [l].

All ſorts of peas love limed or marled land [m]: but when they are ſown late in the ſeaſon, the ſoil ſhould be ſtrong and moiſt; for they will then burn up and periſh in hot light land, or at leaſt not produce a crop worth taking off the ground. The authors of the *Maiſons ruſtiques* [n] approve of ſteeping them twenty four hours in water before they are ſown, as well as to ſeparate the bad and faulty from the good, to enable theſe laſt to riſe the ſooner by being thus moiſtened. In general,

l *Miller's Gardener's Dict.* Art. PISUM.

m MORTIMER, *Vol.* I. *p.* 139. n *Tom.* I. *p.* 674.

the larger the pea is, and conſequently the later it's uſual time of ripening, the earlier it ſhould be ſown, as experience has directed, and as Mr. Liſle rightly infers * from the following curious obſervation, which, if duly attended to, may be of ſervice to huſbandmen and gardeners, and perhaps productive of ſome improvements in the culture of this plant.

In 1708, when the field and garden peas were near a foot high, he obſerved on the very top of them a purſe or neſt of buds of bloſſoms, lying in a bag together; and perceiving at the ſame time that there was no ſhew of bloſſoms putting forth at the lower joints, he concluded that the crops of peaſe would miſcarry that year, that they would not only have ſome top-kid, and that it would be vain to expect any on the lower joints, becauſe they are always forwarder in bloſſoming and kidding than the upper joints, and had not then the leaſt appearance of doing either. This afforded him ſome amuſements in reaſoning: but, not being ſatisfied, in a day or two after looked again into theſe upper pods or bags of bloſſoms, and, upon diſſecting a number of them, found ſometimes in a ſingle one near thirty bids of bloſſoms, two or three of which ſeemed uſually to have got the ſtart of the reſt, and to be bigger in bulk, and taller: moſt of the reſt ſeemed to lie in a huddle, without making any gradations but: as he had never ſeen, excepting the crown pea (which carries all it's bloſſoms in a tuft at top, like a noſegay), other peas put forth above two bloſſoms and kids at top, which ſeldom come to any good, he ſuſpected that the many bloſſoms in this pod, muſt form the ſucceſſive gradations of bloſſoming joints, ariſing from that ſtock as from a common root, and that every bloſſom ſhot forth in order, as it grew forwarder

* *Vol.* I. *p.* 300.

than

than the reſt, while the main ſtem, advancing higher, and higher, left behind the ſubaltern bloſſom of a lower joint. To be clear in this, he tied ſcarlet threads juſt under ſeveral of theſe pods, that he might know them again, and, as he expected, found in four or five days time a gradation of bloſſoms ariſing from joints with lobous leaves above his ſcarlet threads, and the pod of bloſſoms ſtill advanced on to the end, leaving behind farther joints of bloſſoms, till the whole ſtock was ſpent.

From this obſervation Mr. Liſle infers, 1, that by looking into this pod, or purſe of buds, while it is yet ſo much in it's infancy as only to be viewed by a magnifying glaſs, we may judge what hopes there are of a future crop, provided the ſucceeding months prove favourable: and, 2, that we may learn from thence what ſort of peas to adapt to every ſort of ground: —— "but, continues he", before I enter on this part and uſe "of the abovementioned obſervation, I muſt, for "the better underſtanding thereof, premiſe, that "the farmers vary in their judgment in no one "point ſo much as in the nature of the pea. Se"veral ſorts of peas are commonly ſown within "the limits of the ſame pariſh, and each of the "perſons who ſow them generally has a great "prejudice to any other ſort than that which "he ſows, having perhaps been diſappointed of "his expected return from other peas, when he "has ſowed them, and being, for the ſame reaſon, "equally diſpoſed as readily to alter his opinion "of his laſt favourite kind; for the produce of a "crop of peas is always very uncertain. —— But "if the farmer would conſider, from the fore"going obſervation, how early or rath-ripe a pea "is, or how late in ripening, in it's nature; and "that (as all it's ſtock or power to put forth

" bloſſoms lies within the foliage of one pod) the
" art muſt reſult from thence, ſo to ſow the peas,
" in ſuch ground, and at ſuch time, that each ſort
" of pea, according to it's nature, may, before
" autumn and cold weather come to check them,
" ſend forth all it's gradations of joints or bloſſoms,
" ſo that none may become abortive for want of
" ſummer enough to enable nature to bring her
" embrios to maturity, and carry the bud-bloſ-
" ſoms into kids; — then it is apparent (as all
" large peas ripen late, and run to great haulm
" or ſtalks, and ſmall peas have leſs haulm and
" ripen earlier,) that the great or late-ripe peas
" ſhould be ſowed as early as the climate will
" permit; for thereby ſuch pea will get ſo for-
" ward as to have time to put forth all it's grada-
" tions of bloſſoms and kids, and to perfect them
" before a rainy autumn comes, and puts a ſtop
" to farther vegetation. — Again, great peas
" ought to be ſowed on a white, or ſome mixt
" land, not too groſs of juice; but not on a cold
" clay: for the moiſture of this laſt will keep
" feeding the haulm, and be inconſiſtent with the
" main deſign of ſowing them early, which is, that
" they may bring all their fruit to maturity in
" due time. The white or mixt mould muſt be
" in good heart; for otherwiſe it cannot maintain
" a great pea. On the other hand, it is evident
" from hence that a pea which ripens early ſhould
" be ſowed in a ſtrong feeding land, becauſe ſuch
" land will nouriſh it more vigorouſly, without
" danger of too great an increaſe of it's haulm,
" which is naturally ſhort; and, notwithſtanding
" the coldneſs of the ſoil, there need be no doubt
" but that all the kids will ripen."

Moderate rains are of ſingular ſervice to peas while they grow, and particularly at their time of bloſſoming and filling up their pods; but a continuance

tinuance of cold rain for many days, is perhaps as prejudicial as too much heat or drought. The blueiſh bloom upon their leaves, and their expending backward the two outermoſt and largeſt leaves of their bloſſoms, are undoubted ſigns of great health and vigour. Mr. Liſle is of opinion, that they neither ripen nor harden ſo well upon high grounds, as in vallies, and conſequently that the former are not ſo fit for keeping as the latter.

Among the very few experiments on the culture of peas in field, the following, which M. Duhamel has given [p], afford a pretty ſtrong conviction of the benefits which ariſe from horſe-hoeing between their rows.

In April, 1753, M. de Villiers, one of that ingenious gentleman's correſpondents, ſowed a ſmall field in Champagne, with peas, in double rows. Not being provided with a proper inſtrument to hoe the intermediate ſpaces, he made uſe of a narrow angular kind of ſhare, which ſtirred only three or four inches on the outſide of the rows Almoſt all the peas in his neighbourhood were deſtroyed that year by a kind of vermin called vine-fretters. His were hurt the leaſt of any; which was probably owing to the greater vigour of the plants, or the inſects being killed by the ſtirring of the ground. By a compariſon which he made of the produce of this ſpot, he found that it yielded ſix times as much as the ſame extent of the beſt land in the ſame country. "In "a good year" ſays M Duhamel, the difference would not have been ſo great: but ſtill this experiment "ſhews that plants cultivated in the "new or horſe-hoeing way, are better able to reſiſt "the inclemencies of the ſeaſons, and other acci-

[p] *Culture des Terres, Tom.* IV. *p.* 55 *and* 57.

"dents, than thoſe which are cultivated according "to the old method."

The next year, M. de Villiers, being provided with M. Duhamel's drill and horſe-hoe, ſowed peas again in rows, in ſome places two feet, and in others two feet and a half aſunder. But this diſtance was ſo narrow that it rendered the horſe-hoeing very difficult in many places, and quite impracticable in others. He was therefore obliged to contrive other means of ſtirring the ground, in which, notwithſtanding this, his peas flouriſhed extremely, and yielded more than any others on the very beſt land in the ſame diſtrict.

The ſame gentleman drilled peas again, in 1755, in a ſtrong heavy ſoil, in which no one had ever ventured to ſow any in the common huſbandry [q]. They grew as high as if the ground had been ever ſo fit for them, and yielded half as much again as any ſown in the common way, beſides the ſaving in the ſeed, which, in peas thus drilled, is about one half. They were ſown in double rows, with a ſpace about two feet and a half wide between the outmoſt rows of one range and the next outmoſt row of another, and this ſpace was ſtirred with the horſe-hoe.

When any particular ſorts of peas are intended for ſeed, they ſhould be carefully looked over whilſt in flower, in order to draw out all ſuch plants as are not of the right ſort; for there will always be, in every ſort, ſome roguiſh plants, as the gardeners term them, which, if left to mix, will degenerate the kind. As many rows as may be thought ſufficient to furniſh the deſired quantity of ſeed, ſhould then be marked out, and left till their pods turn brown and begin to ſpile, when they ſhould immediately be gathered up,

[q] *Ibid. Tom.* V. *p.* 129.

with

with the haulm; and if the huſbandman has not room to ſtack them till winter, they may be threſhed out as ſoon as they are dry, and put up in ſacks for uſe: but particular care ſhould be taken not to let theſe remain too long abroad after they are ripe, becauſe wet would rot them, and heat, after a ſhower of rain, would make their pods burſt in ſuch manner that the greateſt part of their ſeeds would be loſt. Theſe precautions are indeed more eaſily obſerved in the management of peas in a garden, than in the field where much larger quantities are raiſed: but they are highly proper alſo in theſe laſt, and will well reward the extraordinary pains of the husbandman, who, as was ſaid before, ſhould not continue to ſow ſeed of the ſame growth upon the ſame ground, longer than two years at moſt, but ſhould rather exchange his ſeeds every year.

When peas are reaped, which is commonly done with a long ſtick, they are laid up in ſmall heaps, and left in the field till their haulm and pods are dry: but during this time they ſhould be turned frequently, and raiſed from the earth as much as can be, that they may lie hollow for the wind to dry them, eſpecially when any rain happens to wet and beat them down. In Leiceſterſhire, they ſet all their peas abroad in ſtacks and houſe none; becauſe, ſay they, ſetting them abroad gives them a good colour, but laying them up in a barn makes them look dark. In ſome countries they mow their peas: but that is a bad practice; for the ſcythe muſt inevitably cut aſunder many of the pods, and conſequently be the means of ſhedding great part of the grains.

Vetches.

A particular examination of the ſeveral differences which botaniſts point out between the various ſpecies

ſpecies of vetches, would, perhaps, tend to ſwell this work, rather than convey much inſtruction to the farmer, who is accuſtomed to the more general diſtinction of black and white, ſummer and winter, vetches.

Some ſorts of this plant, the ſeeds of which ripen in autumn, grow naturally in moſt parts of England, in ſhady places among buſhes, and by the ſides of woods. The roots of theſe are perennial; but their ſtalks are annual, weak, and grow to ſo great a length (for they will climb up to the height of ſix or eight feet wherever the tendrils which proceed from the end of their leaves can lay hold of boughs, branches, or the ſide of a hedge, to ſupport them), that they are hardly fit to be cultivated in the field, though ſome writers have recommended them for this purpoſe: for as they cannot be ſupported there, they will trail ſo much upon the ground, that they will be apt to rot: nor do their ſhoots, which are leſs ſucculent than thoſe of the vetch commonly raiſed, grow to a ſufficient height to be cut for uſe till late in the ſpring, when there is little want of green food for cattle.

Mr. Miller[a], after ſowing for many years the common vetch or tare, which is much cultivated in the fields for fodder, ſeems to think that which has black ſeeds, a diſtinct ſpecies from the white: for he has never found either of them vary. Both theſe are annual, and periſh ſoon after they have perfected their ſeed. Their ſtalks are angular, ſtreaked, and hairy: they are weak, and want ſupport, and generally trail upon the ground when they do not find any thing to faſten themſelves to. Their leaves are compoſed of ſeveral pair of blunt lobes, and are terminated by tendrils.

[a] *Gardener's Dict.* Art. VICIA.

drils. The flowers, which are pretty large, proceed from the wings of the ſtalk, and ſit very cloſe to the baſe of the foot ſtalks of the leaves. Two of theſe flowers generally ſpring from the ſame joint: thoſe of the black ſeeded ſort are purple, and thoſe, of the white ſeeded are white. They appear in June and July, and are ſucceeded by erect pods containing three or four round ſeeds in each, which ripen in Auguſt and September.

The white vetch is rather the more ſucculent plant of the two, and therefore is beſt for fodder: but many are unwilling to cultivate this ſort, becauſe their ſeeds, being white, are much ſooner diſcovered by rooks and other birds, than thoſe of the black, which bear a nearer reſemblance to the colour of the ground. This objection may, however, be eaſily removed, by ſowing them in drills, and then covering them carefully, inſtead of the uſual method of ſcattering them with a broad-caſt, and plowing them in lightly.

The ſmall black-ſeeded vetch, which ſome call rath-ripe, and others pebble, or ſummer vetch, is much tenderer than either of the former, and therefore leſs cultivated. This muſt always be ſown in the ſpring: whereas the others may be ſown in ſpring or autumn.

But another ſpecies of vetch, *viz*, the Siberian, hardly known, I believe, to the generality of farmers in this country, bids fair to become, perhaps, the moſt uſeful of all for fodder; for it's ſtalks grow to a great length, and are well furniſhed with leaves, which do not decay in autumn, like thoſe of the other ſorts, but continue green all the winter, in defiance of the hardeſt froſt: ſo that in February and March, when there often is a ſcarcity of green fodder for ewes and lambs, this may be of ſingular ſervice, eſpecially if theſe

plants

plants are ſupported from trailing upon the ground. Their flowers, which appear in July, are of a light blue colour.

This, like, our common vetch, may be ſown in the ſpring, or in autumn; and when the plants are come up, they will not require any other culture than keeping them clear from weeds; a work which, if the ſeeds are ſown thin in rows four feet aſunder, as Mr. Miller rightly adviſes, may be eaſily done with the dutch hoe, while they are young, and afterwards with the hoeing plough. By this thin ſowing, the ſtalks of theſe vetches, which ſend out many branches, and extend very far, will be kept from matting ſo cloſely together as to rot each other by excluding the air; and by earthing up their ſtems in the ſame manner as ſhould be done for peas and beans, they will be greatly ſtrengthened, their leaves will grow the larger and more ſucculent, and they will conſequently yield an increaſed quantity of fodder. The repeating of this as often as it may be found neceſſary to deſtroy the weeds in ſummer, which may be done at a very ſmall expence, and is particularly proper when the growth is intended for the green food of cattle, will be attended with the farther important advantage of preparing the ground thoroughly for whatever other crop may afterward be put upon it.

As the plants of this kind of vetch will not be in danger of being hurt by froſt, they ſhould not be cut till the ſpring, when the beſt way will be to take them as they may be wanted, green, for the feeding of ewes: but ſome of them ſhould be left untouched, for ſeeds; for if thoſe which are cut do ſhoot out again, they will flower ſo late in ſummer, that their ſeeds will not ripen, unleſs the autumn proves very warm. A better way will therefore be to ſow a proper quantity of

ſeeds

ſeeds for this purpoſe in a ſeparate ſpot of ground: becauſe, when the other is cut, the ground may be plowed for other crops; and if the ſeaſons ſhould be ſo mild as to produce a ſufficiency of green food independent of this, the vetches may be plowed into the ground, to which they will be an excellent dreſſing for other crops.

Mr. Miller, who has a high opinion of this ſort of vetch, and whoſe recommendation of it ought to have very great weight, is now beginning to try it in the field, where he has not yet had experience of it's culture: but the experiments which he has made with it for ſix years paſt, on ſmall patches of it ſown in gardens, in different ſituations, have fully anſwered his expectation: for he has found theſe plants continue in great verdure in all thoſe places, when moſt of the perennial plants in the ſame ſituation have ſuffered greatly by the froſt, and could have cut from only eight of them as much fodder as would have been equivalent to half a truſs of clover.

Vetches are generally ſown either in autumn, or early in the ſpring: but the beſt time, in this country, is toward the beginning of Auguſt; becauſe the rains which uſually fall about that ſeaſon will bring them up in a ſhort time, and the plants will get ſtrength before winter, and be fit to cut for the food of cattle early in the ſpring, when green fodder is moſt wanted: and if they are deſigned for ſeed only, theſe early ſown vetches will come early into flower, and their ſeeds will ripen early, ſo that they may be cut and ſtacked in good weather, which is a great advantage; for thoſe which ripen late, are often ſtacked or houſed wet, and then their ſeeds frequently ſprout in the mow, and are ſpoiled,

Vetches will do well in almoſt any ground; not excepting even ſuch as can ſcarcely produce any other.

other plant[b]. The common method of ſowing them is in broad-caſt, ploughing them lightly in, as was obſerved before; and the uſual allowance is two buſhels of ſeed for an acre of land; though ſome ſow two buſhels and a half. Either of theſe practices may do well enough for thoſe vetches which are intended to be cut for fodder in the ſpring; but when they are ſown with a deſign to let them ſtand for ſeed, it will certainly be much better to ſow them in drills, in the ſame manner as is practiſed for peas; and in this caſe leſs than half of the abovementioned quantity of ſeed will be ſufficient: for the rows ſhould be at leaſt three feet aſunder, that the hoe-plough may have room to go between them, to deſtroy the weeds, and earth up the plants, which, when thus managed, will produce a much greater crop, and ripen better and earlier, than in the common way. Theſe drills ſhould be of about the ſame depth as for peas, and the ſeeds ſhould be ſcattered at about the ſame diſtance in the drills, in which they ſhould be carefully covered over as ſoon as they are ſown; for otherwiſe the rooks will diſcover them; and when thoſe voracious creatures once find the rows, they will ſpeedily deſtroy them intirely, if they are not carefully watched. The preventing of this is another advantage which attends the ſowing of vetches early in autumn, rather than in the ſpring: becauſe there is more food for rooks and pigeons in the open field in the former of theſe ſeaſons, and the plants will then appear much ſooner above ground. Toward the end of October, by which time the plants will have acquired conſiderable ſtrength, the horſe-hoe ſhould begin to work between the rows, provided the weather be dry: and in doing this, par-

[b] *Maiſons ruſtiques, Tom.* I. *p.* 669.

ticular

ticular care ſhould be taken to lay the earth up as high to the ſtems of the plants as can poſſibly be, without covering their tops. This will help to ſecure them againſt froſt, and clear the ground of weeds at leaſt till March, when the plants ſhould be earthed up a ſecond time, and the intermediate ſpaces between their rows be cleaned again, in the ſame manner as before. This will make them grow ſo vigorouſly, that they will meet and cover thoſe ſpaces in a little time: whereas thoſe ſown in the ſpring will not grow to half this ſize, and will be very late in flowering.

When vetches are intended only for fodder, of which they generally afford two good crops in the year, in hot countries, or when the farmer deſigns them for plowing in, by way of manure, they need not be ſown in drills, or huſbanded in the manner directed: the common broad-caſt way will then do well enough: but ſtill it is moſt adviſeable, in either caſe, to ſow them early in autumn; becauſe, in the firſt place, they will produce the deſired green fodder much the earlier in the ſpring; and in the ſecond, they will be fit to plow in much ſooner the following year, and thereby have time properly to meliorate the land, and prepare it to receive the enſuing crop, which they are generally allowed to do even more effectually than peas. Stiff clays are peculiarly benefited by this dreſſing: but it ſurely is bad huſbandry to ſow vetches for green fodder, where lucerne will thrive; becauſe this laſt will yield greater plenty of ſtill more nouriſhing food.

In ſome countries, eſpecially abroad, they mix oats with their tares or vetches, an equal quantity of each, and ſow them in February. The vetch, ſupported in ſome meaſure by the oat, grows the higher for it: and, about the middle

of

of May, this mixture is mowed, and given to horſes and other cattle, which it fattens greatly [c]. Mr. Mortimer [d] likewiſe thinks it a good way to ſow horſe-beans and tares together: their ſeeds are eaſily parted with a riddle: and another obſervation in which he agrees with the *Maiſons ruſtiques*, is, that more vetches ſhould not be ſown at any one time, than can be covered the ſame day, becauſe the dew is apt to ſpoil them: conſequently they ſhould not be ſown till two or three hours after the riſing of the Sun; by which time the mixture will be exhaled from off the ſurface of the earth. But though their ſeeds cannot bear dampneſs, which would ſoon rot them, their plants, eſpecially in ſandy land, often periſh in dry years, for want of water. To make them flouriſh well, they require a ſhower of rain every ten or twelve days. One plowing to turn in the ſtubble of the preceding crop, and another at the time of ſowing, are ſufficient for this plant: but thoſe who give only one plowing, which is when they ſow, and afterwards harrow in the ſeed, neither have, nor can expect, an equally good return.

When vetches are cultivated for their ſeeds, they ſhould be cut ſoon after the pods turn brown, and ſtacked as ſoon as they are dry: for if they are ſuffered to lie out in the field, till they receive wet, and there then comes a hot day, moſt of the pods will burſt, unleſs they happen to have been blighted; in which caſe they will not open ſo eaſily. Their haulm, when dry, and threſhed, is eſteemed good food for cattle, and ſome ſay that their ſeeds are as good for horſes, as beans; which, if true, ſhould render them the more valuable, becauſe theſe will grow on the lighteſt

[c] *Maiſons ruſtiques, Tom.* I. *p.* 669. [d] *Vol.* I. *p.* 140.

ſandy

ſandy land, where beans will not thrive; and may therefore, as Mr. Miller obſerves [e], be a good improvement to ſome counties in England where they do not even attempt to cultivate the bean. About three loads from an acre are reckoned a good crop.

Vetches, when threſhed out, will be as good for ſowing at the end of five or ſix years, as at firſt, if care be taken to turn them in the heap from time to time [f]. Mr. Mortimer [g] cautions the husbandman to lay them by themſelves in ſome convenient place, ſeparate from his other corn, becauſe they will otherwiſe be apt to foul it.

It is commonly ſaid, that the farmer cannot ſow any thing more profitable than vetches; for that, beſides inriching the land, a load of them will go farther then two loads of hay: but Mr. Liſle has a calculation [h] tending to prove, that an acre of broad clover is worth twenty ſhillings a year more than an acre of any vetches, and that the clover ſhould therefore be preferred, wherever the ground will bear it well.

Lentils.

Lentils grow to the height of about a foot, or a foot and a half, with ſtalks and leaves like thoſe of Tares, but ſmaller, and; like them, they bear their ſeeds, generally three or four in little pods. Theſe ſeeds are round, hard, ſmooth, and flat, but thicker in the middle than at the ſides. Of the two ſorts which are commonly cultivated, the white is moſt eſteemed for the food of men; but the yellow, which is the largeſt, affords the greateſt quantity of fodder. The bloſſoms of the firſt are of a purpliſh white, and thoſe of the laſt are quite

[e] *Gardener's Dict.* Art. VICIA.
[f] *Maiſons ruſtiques, Tom.* I. *p.* 669. [g] *ubi ſupra.*
[h] *Obſervations in Huſbandry, Vol.* I. *p.* 304.

white. The *Ervum*, or ſmall black lentil, is too bitter to be eaten.

Lentils do beſt in a middling ſoil. There they yield an immenſe increaſe, if too much rain does not fall while they are in bloom: but in rich land, they grow too luxuriant to ſeed well. The common cuſtom in foreign countries, (where they are much uſed in ſoups, &c.) is to let them lie four or five days mixed with dry dung [a], in order to make them ſprout the ſooner, then to ſow them with that dung (which is alſo Columella's advice [b] after either one or two plowings, but two are beſt, and to harrow them in lightly; for they muſt not be buried deep. Some allow even more than two buſhels to an acre of land: but one buſhel is full enough, for they branch out very much. In hot countries, where it is common to have two crops of this grain in a year, the uſual times of ſowing it are, towards the end of October, and in the month of February: but March is the moſt proper ſeaaſon in our temperate climate. The lentils ſown then, will bloſſom and ripen in July and Auguſt. They are a very good ſweet fodder; perhaps the beſt of any for calves and other young cattle; and their ſeeds are the cheapeſt of food for pigeons. Great care muſt be taken to cleanſe and dry them well in the ſun, before they are laid up, and to keep them in a very dry place, for the weevil is extremely apt to breed in them. When properly preſerved, they grow exceeding hard, and will keep a great while.

Lupines.

This plant, which is a kind of wild pea, requires the leaſt labour of any thing that is ſown. It will thrive in any ſoil, except the chalky and miry, but delights particularly in poor hungry

[a] *Maiſons ruſtiques p.* 675. [b] *Lib.* II. *c.* 10.

worn

worn out land, eſpecially if it be dry and ſandy. If ſown in February or March, after a ſingle very ſhallow plowing, and ſlightly harrowed in, or even harrowed in without any plowing, it will bloſſom three times between May and Auguſt, and prove an excellent enricher of the ground when plowed in juſt after it's ſecond blooming: though Mr. Miller[c], holding the lupine to be a very great impoveriſher of the ground whilſt it grows, thinks it is ſtill better to parboil the ſeeds, to prevent their ſprouting, and then to ſtrew about ſixteen buſhels of them upon an acre of land, and plow them in. In warm countries, lupines are much ſown in vineyards for this purpoſe only, and are found to be one of the beſt manures that can be laid to the roots of the vines[d]. Their ſeeds ripen towards the end of September, or in the beginning of October. They are very bitter: to remedy which, the Spaniards and Italians, who feed their cattle, horſes not excepted, with them in winter, ſteep them in river water and ſalt till that bitterneſs is gone, and afterwards dry them thoroughly over a fire, or in the ſun. They even make bread of them, when corn is very ſcarce, and put them to ſeveral other culinary uſes. The beſt time for mowing them is after a ſhower of rain, becauſe the ſeeds drop eaſily out of their pods when they are gathered to dry. They muſt, however, be laid up very dry, or worms will ſoon breed in them. The red and the blue lupines, which are frequently planted in our gardens by way of ornament, grow wild, and in great quantities, about Madrid.

[c] *Gardener's Dict.* Art. LUPINUS.

[d] COLUMELLA, *Lib.* II. *c.* 10. *Maiſons ruſt. Tom.* I. *p.* 676.

END OF THE FIRST VOLUME.